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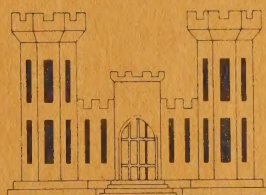
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DETAILED PLAN OF STUDY

OF

SAN FRANCISCO BAY AREA IN-DEPTH  
STUDY

*San Francisco Bay  
Harbors - Ca. - San Francisco Bay region*



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DETAILED PLAN OF STUDY  
OF  
SAN FRANCISCO BAY AREA IN-DEPTH STUDY

8 MARCH 1971

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DEPARTMENT OF THE ARMY  
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS  
100 McALLISTER STREET  
SAN FRANCISCO, CALIFORNIA 94102

SPNED-RN

8 March 1971

SUBJECT: Detailed Plan of Study, San Francisco Bay Area In-Depth Study

THRU: Division Engineer  
U.S. Army Engineer Division, South Pacific  
San Francisco, California 94102

TO: Chief of Engineers  
Department of the Army  
Washington, D.C. 20315

INTRODUCTION

This Detailed Plan of Study on the San Francisco Bay Area In-Depth Study has been prepared in response to a request by the House Committee on Appropriations. It sets forth the objective of the study, the areas to be investigated, the particular Federal agencies associated with the major study analyses because of their established responsibilities and expertise in that field of endeavor, the estimated time and magnitude of costs required to complete these tasks. A PERT (Program Evaluation Review Technique) diagram (Exhibit 1) reflects actions taken by the District Engineer in the development of the Detailed Plan of Study. A CPN (Critical Path Network) chart for the In-Depth Study (Exhibit 2) is included as part of this report. The CPN diagram identifies generally the study items to be considered, including timing and sequencing of the study program.

The study contemplated is a multi-agency, multi-discipline endeavor involving the engineering, economic, physical, biological and social sciences. The study will be conducted with a view towards developing guidelines for navigation facility planning, giving equal consideration to competing uses of the Bay Region and hinterland resources, particularly those relating to regional, environmental, and social well-being objectives.

The study is estimated to cost \$4,500,000 in addition to previous allocations of \$230,000 prior to FY 1972. Major study efforts will be conducted over the three-year period FY 1973 through FY 1975.

The remainder of FY 1971 and FY 1972 will be used to initiate component study analyses. Time and funds projected for FY 1976 will be devoted to preparation of the draft report, review and comment by interested Federal, State, and local agencies, public meetings, and completion of the final report. Study costs beginning with FY 1972 are summarized in Table 1.

In regard to the matter of local participation, local interests, public entities (cities, counties, and port authorities) and private interests (financial, shipping, and industrial) have agreed to make available to the Corps of Engineers completed studies, on-going study programs, and other data which will contribute to the study. Preliminary analysis indicates that the value of the inputs from non-Federal agencies and private entities will amount to a significant contribution, approximately equal to the new work contemplated in this report.

As now contemplated, the study effort presented in this report, exclusive of non-Federal coordination activities, would be financed by the Federal Government. The Corps of Engineers, representing the Department of the Army, would act as the lead agency. The Corps would submit a unified Federal budget request and transfer allocated funds to other participating agencies that require them for special study analyses.

Three public hearings were held in June 1970 on the In-Depth Study. Material presented at the hearings is summarized later in this report. Details on hearing presentations are presented in Appendix B to the report. As shown on the CPN chart (Exhibit 2), additional public meetings are scheduled throughout the course of the study program.

To provide information on the status of the study, the testimony presented to the Appropriations Committees each year will give a review of the progress and accomplishments.

#### AUTHORIZING LEGISLATION

The San Francisco Bay Area In-Depth Study was authorized pursuant to a resolution adopted by the Committee on Public Works, House of Representatives, on 19 October 1967, (Navigation Docket No. 1635). The Resolution reads as follows:

#### RESOLUTION

"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on San Francisco Bay and all tributary deep water ports, as contained in two resolutions



adopted by the Committee on Public Works of the House and Senate (Resolutions authorizing Comprehensive Bay Survey and San Francisco-Sacramento-San Joaquin Delta Study); and Reports published in House and Senate Documents (San Francisco Harbor, Redwood City, Lower San Francisco Bay, Oakland Harbor, Richmond Harbor, San Pablo Bay and Mare Island Strait, Sacramento Deep Water Channel, Suisun Bay, San Joaquin River, Stockton Channel).

The investigation is to be undertaken with the object of promoting and encouraging the efficient, economic, and logical development of the harbor complex and its hinterland. The scope will encompass investigation of current shipping problems, adequacy of facilities, delays in intermodal transfers, channel dimensions, storage locations, and capacities, and other physical aspects affecting Golden Gate waterborne commerce.

The investigation shall include, but not be limited to, the impact of waterborne commerce in the Golden Gate region on the local, national and international economies, and its relation thereto; research into current and future markets for the import and export commerce of the region; evaluation of regional Pacific Coast integrated approaches toward the opportunities and problems engendered thereby; an inventory of regional shipping facilities, capacity, and operating entities and an evaluation thereof; a study of industrial and trade trends owing to new and improved technological advances, methods, improved vessel design, cargo handling facilities, extension of automation, and other cargo, vessel and operating concepts; relationship of waterborne shipping to other modes of transportation with particular reference to intermodal transfer and facilitation of through-shipments; comparison of the status and future of Bay Region ports and terminals with other national and international harbor complexes; recommendations for types, sizes and locations of future facilities, and improvements and expansions of existing facilities, including deep-draft navigation channels; recommendations for improvements in harbor and industrial operations and development through improved coordination and programming, including solicitation, market research, public relations, advertising and long-term planning; determination of the adequacy of the region's shipping capacity in terms of its role in the defense mobilization base, and citing any inadequacies therein; the role and functions of the harbor complex in Pacific Basin development; presentation of guidelines for regional development to the extent required by navigational uses and potentials;



contributions possible on balance-of-payments through expanded commerce and more efficient harbor operations; determination of bulk movement projections, including estimated raw material requirements of the regional and national economy possible of shipment through the Golden Gate, with particular reference to economies afforded by use of super-sized bulk transport vessels and tankers; advantages afforded to the Government by waterborne commerce's contributions of increased tax revenues and improvements in balance-of-payments; effects on the regional and national economy of new and expanded heavy industry and ancillary industry and ancillary industries dependent thereon as a result of improved navigation and more efficient harbor operations; and desirability and extent of Federal participation in securing adequate bases for expansions and improvement of shipping facilities and further integration of regional planning for waterborne commerce."

The Resolution was sponsored by Congressmen Don H. Clausen, Jerome R. Waldie and Harold T. Johnson.

#### AUTHORIZATION BACKGROUND

The San Francisco Bay Area is considered not only one of the greatest harbor complexes in the world in terms of economic activity, but also one of the world's most valued urbanized areas in terms of major scenic and environmental resources. Because of these valued intrinsic resources and the associated economic activities, the future development of the entire Bay region and its resulting west coast, national, and even international associations are of vital concern to many varied groups and individuals within and without the San Francisco Bay region.

At the present time the array of heterogeneous economic, environmental, and social conditions and activities occurring in the entire San Francisco Bay region are concentrated near the Bay itself. As a result, the competition for a variety of land uses of the shoreline for recreation, port operations, industrial activity, transportation systems, and wildlife habitat is becoming increasingly intense.

Such concern in recent years has led to a great deal of research by public agencies (local, State and Federal), private industry, research corporations, and educational institutions into the varied environmental, social, and economic activities of the San Francisco Bay region. Among the major investigative efforts



(discussed later in this report) are the studies by the Corps of Engineers presented in a report entitled "Technical Report on Barriers," the San Francisco Bay Conservation and Development Commission, the Association of Bay Area Governments 1970-1990 Regional Plan, the Regional Airports Systems Study, the Bay Area Transportation Report and many other studies dealing with detailed areas of economic activity, industrial growth trends, open space programs, and other development requirements.

Although the investigations by various agencies and groups contribute greatly toward planning for the optimum development of the Bay region, the role of waterborne commerce and port developments, with their many physical and economic influences on growth, has not been properly determined. The far-reaching physical and economic activities associated with waterborne commerce concerning technological innovations in vessel design, cargo handling techniques and facilities, channel depth requirements, intermodal operations, economies of scale, and many other factors have a great and lasting effect on the pattern of local, regional and even national growth and development.

The factors affecting navigation developments and waterborne commerce for the Bay region are world-wide in scope and therefore, not only local and regional but international aspects of waterborne commerce must be analyzed in order to establish the guidelines for navigation development for the Bay region.

An analysis of oceanborne commerce indicates that the trends toward greatly increased vessel size for overall world trade could seriously affect the international competitive position of the United States. The primary reason for this concern is that there are no ports in the United States, with the possible exception of Seattle, that can accommodate the largest tankers and bulk carriers now in operation. Presently, few United States harbors have controlled channel depths greater than 45 feet, or far short of the depths required to accommodate many of the larger tankers already in service.

In October of 1968 the first of six 326,000 dwt\* tankers began operation. These vessels have a draft of over 80 feet when loaded. In June 1969, 50 tankers larger than 150,000 dwt were already in service, and another 150 were on order. One hundred fifty thousand dwt tankers require channels 60 to 65 feet deep. Many experts

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\* Deadweight tons (dwt). The deadweight tonnage of a ship is its fully loaded capacity in long tons (2,240 pounds), including cargo, fuel, and stores, but not including the weight of the ship itself.

believe that by the year 2000 the upper size limit of tankers operating from United States ports will be about 250,000 to 350,000 dwt. The problem of accommodating these large tankers is primarily one of water depths, and only secondarily of horizontal waterway dimensions.

The largest of the existing tankers carry crude oil over long distances, often under long term leases on particular routes. Petroleum products are customarily carried in tankers of more modest size. Other ship types which are also growing rapidly in size, although not as fast as the crude oil carriers, include the oil, bulk ore (OBO) carriers, and the dry bulk carriers. By contrast the growth of the freighters, both break-bulk type and container, is taxing existing harbor depths to a much smaller degree.

In San Francisco Bay, the 50-foot channel cut through the outer bar across the Golden Gate normally restricts traffic to ships with drafts of 40 feet or less. Under favorable tide and sea conditions, ships with drafts of 45 feet and possibly slightly greater can transit this channel. This effectively restricts tanker and other bulk carrier traffic to ships smaller than about 70,000 or 80,000 dwt. Other types of ships are not normally restricted by this channel. Deepening the channel through the outer bar to 55 feet as authorized would increase the limiting size of tanker and dry bulker to only 100,000 dwt. Channels in the Bay itself are even more restrictive for large ships.

The new large tankers and dry bulkers afford transport of goods at a greatly reduced cost, and the inability of U.S. ports to accommodate them places the country at a competitive disadvantage with the rest of the world. For example, on a 10,000 nautical mile trip, a 50,000 dwt tanker delivers petroleum at about \$0.75 per barrel. A 200,000 dwt tanker delivers at about \$0.32 per barrel. Since about 20 percent of the total waterborne tonnage for the San Francisco Bay region is crude petroleum, the economy afforded by any increases in the maximum tanker size which can be accommodated is important to the waterborne commerce and related activities in the Bay region.

Another factor greatly influencing world trade and port development is the rapidly accelerating growth of containerization. By 1969, there were 150 container-carrying ships operating in international trade, with an additional 90 new containerships to enter service shortly. Many of these vessels handle over 1,000 twenty-foot containers at speeds up to 25 knots.



Based on current trends, announced plans, and major vessel study reports, the continuing growth of the containership fleet will be accompanied by increases in vessel speeds to 33 knots and capacities for 2,000 twenty-foot containers. The main advantages resulting from containerization are the shortened commodity delivery time because of rapid handling techniques in port and the resulting rapid turn around time of the vessels. Since these new ships must turn around quickly in order to operate economically, the problems of fast fueling, repairing, and efficient berth and terminal productivity will be increasingly explored. Also, inherent in this rapid turn around is the need for point to point service, as will be explained later.

Although present and future containerships do not present the draft problems associated with large tankers in San Francisco Bay, other requirements are demanding. Port facilities development in terms of large land parcels needed for storage areas, large capital expenditures associated with specialized handling facilities and equipment, and the increased inland transportation requirements present a great many problems and conditions to be reconciled. Containerized cargo currently plays a large role in the traffic of certain Bay Area ports and is expected to continue its accelerated growth. Many shipping authorities predict that by the year 2000, 70 to 90 percent of all general cargo could be containerized.

An important variation of the containership which could have a great impact on world shipping in the future is the barge-carrying ocean vessel. The ship carries loaded barges which can be lifted in and out of the water. They do not require a pier and can load and unload in open but protected water outside of inner harbors. They are ideally suited for river ports or shallow and poorly developed coastal ports where cargo must be shipped to and from inland ports by barge. One major disadvantage of these systems, the LASH (Lighter Aboard Ship) and the SEE BEE (Sea Barge Carrier) is that they cannot participate in a fully intermodal system. Their role in national defense as well as for other reasons could be significant.

These innovations in shipping (very large tankers and dry bulk carriers, container ships, sea-barge carriers, etc.) will continue to exert an increasing influence on waterborne commerce development and related activities.

In addition a recent study by the British Transport Docks Board indicated that a transportation system termed the "Land Bridge" offered potential cost savings. Through this system,

containerized cargoes would move by ship from the Pacific Basin to a single specialized port on the U.S. Pacific Coast, possibly in the Bay Region, from where the cargo in containers would move by fast unit trains to a similar port on the Atlantic Coast. Container ships would then move the cargo to Europe. European cargoes would follow the route in reverse. The system would require large and expensive marshalling yards at the ports and inland. However, a subsequent analysis of the newly developed fast containerships indicated that their greater speed from the Far East through Panama Canal to the U.S. East Coast and Europe could offset the savings afforded by the Land Bridge concept. Whether the Land Bridge concept will play a role in the development of the Bay Region port facilities depends on the rates charged for containerized freight moving on unit trains as well as the cost of the specialized facilities required for this type of service and the effect of these works on the environmental and social conditions of the region.

An initial analysis of the factors concerning waterborne commerce and port development included in the existing local and regional land use and transportation plans of the San Francisco Bay Region indicates that the role of regional port development and the pervasive social, environmental, and economic activities associated with waterborne commerce have not been examined in terms of their impact on total regional planning and development. The importance of waterborne commerce to the future development of the region is attested by the estimate that the total 1968 Bay Region tonnage of about 52 million would quadruple\* by 2020. Existing navigational development in the Bay Region is discussed later in this report.

The inadequacy of present Bay Area port facilities to handle the anticipated levels of commerce is evidenced by improvements now under construction and further developments in the planning stage. Many of the ports face major physical and economic problems. In terms of land use, port development or expansion in certain areas would require bay fill or displacement of existing residential, commercial, or industrial activity at extremely high costs with related major environmental and social well-being problems. Any port development may affect local and regional port-related employment patterns, as well as the physical development of the adjacent and associated land use activities.

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\* Preliminary findings of the Federal-State Framework Study for the California Region.



As a result of technological innovations in ship design, cargo handling, and intermodal operations and as a result of the environmental, social, and economic implications involved with port development on all levels, the need for determining the role of port development and waterborne commerce in total regional development is exceedingly evident and critical.

#### PRELIMINARY PLAN OF STUDY

A Preliminary Plan of Study for the In-Depth Study was completed in March 1969. The Plan included a detailed analysis of the authorizing legislation and preliminary evaluation of investigation effort and available data. Public hearings were not held; however, available data and views of others were obtained through meetings.

The Preliminary Plan generally identified: study objectives; scope of study, elements to be studied; participating Federal agencies; potential non-Federal participation; time and sequence program; review of cost; and, conclusions and recommendations. Preliminary cost estimates for study areas indicated that a total of \$4,500,000 would be required, \$2,500,000 for Corps of Engineers activities and \$2,000,000 for other Federal agencies. It was noted that costs for work for other agencies was estimated by the Corps in the absence of information from these agencies.

Conclusions of the Preliminary Plan were: that there was favorable and widespread interest in the study; the study would fill a critical regional planning need; and, the findings would be beneficial to the region, State, and nation. A significant non-Federal contribution to the study would be derived from concurrent and specific local planning programs.

Recommendations in the Preliminary Plan called for public hearings, preparation of a Detailed Plan of Study and initiation of major study investigations.

An Appendix to the Preliminary Plan presented details on meetings and letters received from interested parties.

The Congress concurred in the Preliminary Plan recommendations for public hearings and preparation of a Detailed Plan of Study, and directed that the authorized funds in the FY 1971 budget not be used to initiate the investigation until the Appropriations Committees of the House of Representatives and of the Senate have approved the Detailed Plan of Study.

## OBJECTIVE

The objective of the study is to prepare guidelines for alternative regional navigation plans to accommodate waterborne commerce in the San Francisco Bay Region within the context of needs for environmental protection and enhancement and general community well-being. The output of the comprehensive investigations contemplated in this study will be a series of navigation development alternatives for different levels of commerce, together with their physical, financial, environmental, and social implications. This array of alternatives will range from those favorable to the environment and social well-being to those favorable to economic development of the Bay Region. The guidelines will be defined in terms of the specific outputs of the study and will include the following:

1. Channel depths, channel alignments, new channels, dockside facilities, and back-up areas associated with different levels of future commerce;
2. Alternatives to navigation and port facilities under different levels of future commerce (for example, the use of pipeline to transport petroleum into, through, and out of the Bay Region);
3. Requirements on other transportation facilities affected by different levels of future commerce (port and intermodal transportation facilities serving the ports in the region);
4. Community well-being requirements (employment, health and safety, land use, recreation, etc.) associated with different levels of future commerce;
5. Environmental and ecological requirements (dredging, land fill, waste disposal, water pollution, oil spill, etc.) associated with different levels of development and the consequence thereof if the guideline requirements are not obtained;
6. The potential of alternative navigation facilities requirements (land and water) for national defense; and,
7. Legal and institutional considerations relative to alternative development.

The guidelines for alternative regional navigation plans will be presented in a manner that could be translated to specific programs or projects.

While the study program is directed to the development of a comprehensive guide for future development, specific findings may be presented for projects necessary to meet near term traffic growth. These projects would be reported separately provided that they meet the following tests:



1. That they generally serve the entire harbor and port system;
2. That they are consistent with all alternatives regardless of emphasis on various objectives; and,
3. That they are not sensitive to major variations and projections of commerce.

Further, the development of a comprehensive plan will in no way preclude or defer for future action the execution or completion of already authorized projects that are needed to meet current requirements and that would be elements of any plan for future development. Thus the orderly and continued development of the harbor system can proceed simultaneously with the study.

The final report and supporting technical memoranda will be designed to facilitate non-Federal use to permit maximum integration of Federal effort with all other planning efforts.

#### SCOPE OF STUDY

The scope of the San Francisco Bay Area In-Depth Study will be a multi-discipline study encompassing the engineering, economic, physical, biological and social sciences. The study will be performed as a multi-agency effort among the State, local interests, public and private, and the agencies of the Federal Government.

The approach to be used in formulating the study elements to fulfill the objectives is to: (1) determine the present and potential relationship to other West Coast ports, (2) analyze the intra-port facilities of the San Francisco Bay Region as a port system, and (3) analyze the potential of the San Francisco Bay system for new port, land-side terminal, offshore terminal, and ship-to-ship terminal facilities as supplements to the existing port system.

The comprehensive and multi-discipline nature of the study indicates that the selection and evaluation of alternative port systems should be implemented within the framework of component needs of the following multiobjectives:

National Economic Development Objective

Regional Environmental Objective

Regional Social Well-Being Objective

The evaluation of alternatives also will consider the legal and institutional aspects relating to waterborne commerce and associated activities.

There are other studies that have been completed or are currently being conducted in the San Francisco Bay Area. The relationship of several major regional studies to the In-Depth is discussed later in this report. Most of the current and previous studies are structured to examine specific purposes. The San Francisco Bay Area In-Depth Study has as its intent a broader range of interests which previous studies have indicated should be investigated. The study must address not only these individual elements in greater detail, but also examine these and new areas of concern comprehensively in the context of the present and the future, i.e., competitive beneficial uses of waterways and lands; adequacy of the transportation systems and the influences of foreign growth and natural resources developments on National, West Coast, and San Francisco Bay Region future desires and needs. In order to complete the study, and as shown in Exhibit 2, analyses will be conducted on the following:

Commodity Flow

Vessels and Port Facilities

Transportation Systems

Environment

Social Well-Being

National Defense

Evaluation of the outputs of the study will require a maximum uniformity of the standards for evaluation for all study areas. For example, all facility designs and cost estimates required by study areas would be coordinated through or requested from the Corps of Engineers. Evaluation standards for each of the six study areas will be developed by the respective study coordinators and coordinated through the Corps of Engineers for correlation to insure maximum uniformity.

In order to allow for judgments with respect to time and to provide latitude to accommodate change, study analyses and results for the In-Depth Study will not be tied precisely to specific time frames; instead, time horizons will be established covering short term, medium term and long term periods such as 1980 to 1985, 1995 to 2005, and 2020 to 2040, respectively.

#### AREA OF INVESTIGATION

The nature of the In-Depth Study is such that certain aspects of the study will cover a world-wide area. For instance, the Commodity Flow Analysis will consist of origin and destination studies



tracing the existing and future movements of commodities from the various ports of the world to the Pacific Basin, the United States, the West Coast and the San Francisco Bay Region and vice versa. Conversely, the common investigation area for all study analyses, also the region of primary emphasis, is the San Francisco Bay Region counties of: Marin, Sonoma, Napa, Solano, Yolo, Sacramento, San Joaquin, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco. This primary region is shown in Plate 1. For study effectiveness, the regions of influence have been defined by function as follows:

1. Commodity Flow Region. As stated previously, the Commodity Flow Analysis will cover a world-wide area. However, the degree of detail on international trade data will be on a highly aggregate basis. Commodity flow data of greater detail, in increasing order, will be developed for the Pacific Basin, United States, West Coast, and finally, greatest details will be emphasized for commodity flow into, through, and out of the San Francisco Bay Region.
2. National Defense Region. The study region for the National Defense Analysis is the entire United States with primary emphasis on the role of the San Francisco Bay port system.
3. Vessels and Port Facilities Region. In addition to the San Francisco Bay Region ports, this study region includes all major West Coast port facilities, existing and planned, such as those at Seattle, Portland, Humboldt Bay, Los Angeles-Long Beach, and San Diego and deep-draft ports throughout the world of commercial importance to the San Francisco Bay Area.
4. Transportation Systems Region. This study region has been defined on the basis of major transportation systems feeding into the Bay Region. It includes parts of the States of Washington, Idaho, Wyoming, Colorado, Nevada, and California, and the states of Oregon and Utah as shown on Plate 2. The focus of the Transportation Systems Analysis, however, will be on the San Francisco Bay Region in connection with the movement of cargoes in and out of the Bay port complex.
5. Social Well-Being Region. This study region includes the San Francisco Bay Region and the Central Valley as shown on Plate 3. The Central Valley is included in this study region primarily because of the potential effect of its land use patterns on the economy of the Bay Area.
6. Environmental Region. The environmental study region includes the San Francisco Bay Region and potential adjacent coastal deep-water harbor sites.

## STUDY PROCEDURES

This section presents the various specific steps necessary to accomplish the stated objective and final product of the In-Depth Study. The sequence of events presented herein generally follow those delineated on the Critical Path Network, Exhibit 2, and include the following major study items: initial study inputs; advisory committee; study analyses; selection of alternative port systems; evaluation of alternative port system; technical memoranda; and, guidelines for navigation facility planning. The specific study steps are discussed in the following paragraphs.

1. Initial Study Inputs. Upon approval of this Detailed Plan of Study, preliminary studies will be initiated in the areas of: preliminary estimates of regional commerce, economic projections, environmental objectives, social well-being objectives, general design of potential regional navigation facilities, and an inventory of legal and institutional aspects relating to the In-Depth Study. These studies will permit initiation of the major study analyses which are subject to refinement after the study is underway.

a. Preliminary estimates of waterborne commerce. The preliminary estimates of levels of commerce would be largely based on data from completed and ongoing studies. Four preliminary levels of waterborne commerce would be developed for the following commodity groups: petroleum and liquid-bulks; dry bulks; special handling cargoes (i.e., containerized and LASH type cargoes); and, general cargo. Level 1 and Level 2 projections would be associated with current and planned facility expansion of existing ports, respectively. Level 3 and Level 4 projections would be predicated upon broader economic forces that will likely govern future waterborne commerce in the Bay Region. These estimates will permit an early initiation of the evaluation of factors that must be considered in the final analyses. Future waterborne commerce will be defined more carefully by the Commodity Flow Analysis.

b. Economic projections. The Corps of Engineers will provide projections of economic activity that will serve as the framework for the analyses requiring such projections. These projections will be predicated upon the latest OBERS (Office of Business Economics and Economic Research Service) projections as may be available at the time of the study. In view of possible differences between the OBERS projections and those of the State of California, it will be desirable for some analyses using these projections to indicate the extent to which the variations are likely to be sensitive to the particular evaluation being made. For those evaluations where it will be desirable to project alternative levels of economic development, such as in the Commodity Flow Analysis, these projections will be accomplished on the basis of making explicit and consistent assumptions.

c. Environmental objectives. These objectives would be formulated from the viewpoint of desirable goals for preserving and enhancing the environment of the San Francisco Bay Region. Examples of environmental factors for which objectives would be established are: dredging, as affecting turbidity, salinity and ground-water aquifers; and, land fill, as affecting assimilative capacity of the Bay, loss of fish and wildlife habitat, and reduction of food source and oxygen production. Derivation of these objectives, to be used in the selection and evaluation of alternative port systems, will be the responsibility of the coordinator for the Environmental Analysis.

d. Social well-being objectives. These objectives would be formulated from the viewpoint of desirable goals for enhancing the community well-being of the San Francisco Bay Region. Examples of well-being factors from which these objectives would be established are: distribution of real income, employment, and population; security of life and health; educational, cultural, and recreational opportunities; and, national security. Derivation of these objectives, to be used in the selection and evaluation of alternative port systems will be the responsibility of the coordinator for the Social Well-Being Analysis.

e. Potential navigation facilities. Having derived the preliminary estimates of future waterborne commerce, the Corps of Engineers, in cooperation with the Advisory Committee (See Exhibit 2), will develop potential general plans of port facilities to meet the selected tonnages. The approach for this initial input will be to examine the existing ports and potential new port sites for their full potential capability, unrestrained by environmental, social well-being, or legal and institutional implications. These plans will be in four categories for: conventional facilities (existing, modernized, expanded and new ports); land-side central terminal sites; offshore terminal sites; and, ship-to-ship terminal. Further, general plans within each category and for each individual port or terminal will be by several scales of development so as to allow interchange between ports to meet certain volume and type of commerce during the selection and evaluation of alternative port systems phase of the study.

f. Legal and institutional inventory. An inventory of the existing laws and regulations governing waterborne commerce and related activities will be provided by the Corps of Engineers.

2. Advisory Committee. An Advisory Committee, consisting of Federal, State, Regional and local representatives, will be established at the start of the study. The chairmanship will



be provided by the Corps of Engineers. The Committee will provide overall integration of effort, guidance to the six major study analyses, selection and evaluation of alternatives and the draft-of-report phase. The composition of the Advisory Committee is shown on Table 2. The structure of this Committee would allow maximum data and conceptual contributions toward the study from local, regional and State interests. For maximum coordination, members of this Committee should be at least from the assistant regional administrator level for Federal agencies, from the department head level for State agencies, and from the executive board level for the regional and local agencies.

3. Major Study Analyses. In order to fulfill the study objective, analyses will be undertaken of the following: commodity flow; vessels and ports facilities; transportation systems; environment; social well-being; and, national defense. These analyses are continuous throughout the overall study. The products of these analyses will be prepared as supporting technical memoranda to the main report. A summary of these analyses and how they will contribute to subsequent study analyses and how they relate to each other is given below. Table 3 indicates the Federal agencies participating in each phase and designates which agency will act as the study coordinator. A more detailed presentation of each analysis is given later in this report.

a. Commodity Flow Analysis. This analysis will be initiated concurrent with the previously described initial inputs as it is somewhat independent and requires limited interaction with the other study analyses. It is undertaken to provide a range of potential future waterborne commerce by commodity groups. The projections of the flow of commodity will provide the basic data for evaluation by all other analyses. The Commodity Flow Analysis will be concerned primarily with future commodity flow through the San Francisco Bay Region. Data of international and national scope will be developed and analyzed to the extent necessary to substantiate West Coast and regional projections. Particular emphasis will be given to future trade with Japan because of its rapid rate of development and large contribution to the value and tonnage of waterborne commerce shipped through the West Coast ports. The analysis leading up to projections of future waterborne commerce for the Bay Region will utilize input-output models supplemented by marketing studies of movement of specific commodities. A range of projections for each commodity group will be obtained by the use of a consistent set of assumptions reflecting such items as trade policies, new technology, potential exploitation of new resources, GNP, and transportation cost and location (supertanker port) studies.

b. Vessels and Port Facilities Analyses. These analyses will be undertaken to provide designs and cost estimates of navigation development alternatives for use during the selection and evaluation of alternative phases of the study. Separate analyses will be made of vessel trends, navigation channels, and port facilities to accommodate projected levels of commerce, taking into account objectives and criteria established for the major study analyses. Also analyzed will be potential independent or centralized docking facilities within the Bay Region.

c. Transportation Systems Analysis. This analysis will be undertaken to determine a series of integrated transportation systems (land and air) necessary to adequately handle given levels of commerce of different navigation development alternatives considering the needs of the environmental and community well-being objectives. Separate analyses will be made of the present rail, highway, air and pipeline transportation networks for their capacity to handle various commodity movements. Although water transportation is analyzed under the Vessels and Port Facilities, the physical and economic factors of the existing and projected intermodal aspects of land, air, and water transportation will be analyzed.

d. Environmental Analysis. This analysis will be undertaken to formulate environmental principles to serve as guidelines for future developments in navigation within the Bay Region and potential adjacent coastal harbor sites and to evaluate navigation alternatives for compatibility with these principles. The analysis will be comprised of three phases of development. The initial phase will establish unrestricted environmental objectives which will serve as framework guidelines for the other major study analyses. The second phase will pursue individual items of analysis of the existing and potential modification of the biota, hydrology, geology, physiography, pedology and climate of the Bay Region under various alternative port systems. The third phase will consist of evaluation and application of the individual items of analysis to a group of summary analyses which will provide the basis for the establishment of the final environmental principles.

e. Social Well-Being Analysis. This analysis will be undertaken to formulate social well-being principles to serve as guidelines for future developments in navigation within the Bay Region and to evaluate navigation alternatives for compatibility with these principles. This analysis will be comprised of three phases of development. The initial phase will establish unrestricted social well-being objectives which will serve as framework guidelines for the other major study analyses. The second phase will pursue individual items of analysis on economic factors (population, employment, income, etc.), general welfare factors (health and safety, etc.), and quality of human environment factors (open space, recreation, land use, etc.) associated with future navigation developments. The third phase will consist of evaluation and application

of the individual items of analysis to a group of summary analyses which will provide the basis for establishment of the final social well-being principles.

f. National Defense Analysis. This study will be undertaken to determine the relative role and requirements of the national defense aspects of the San Francisco Bay port system. This analysis will include the appraisal of the present and future capacities of port facilities, and the determination of optimum routing of traffic under different port system configurations as utilized for military purposes.

4. Selection of Alternative Port Systems. The results of the various study analyses will provide the basic data for the selection of alternative port systems phase of the study. This phase of the study will yield regional development factors by considering a discreet set of alternative port systems to meet given levels of future commerce (as provided by the Commodity Flow Analysis) by interchanging different scales of development of existing and potential ports and terminals (as provided by the Vessels and Port Facilities Analyses), giving consideration to the objectives and criteria established by other analyses (Environmental and Social Well-Being, etc.). Preliminary facility designs and cost estimates, and benefits (both quantitative and qualitative, and both positive and negative) which have been developed for individual ports will be combined into potential port systems. The existing legal and institutional framework will be reviewed for compatibility with potential port systems. The selection of alternatives will be approached from the points of view of satisfying the component needs of the following multiobjectives:

a. National economic development. The need to increase the value of the nation's output of goods and services, and improve the national economic efficiency.

b. Regional environmental quality. The need to enhance the quality of the regional environment in relation to the management, conservation, preservation, creation, restoration, or improvement of the quality of natural and cultural resources and ecological systems.

c. Regional social well-being. The need to enhance regional well-being by the equitable distribution of real income, employment, and population; by contribution to the security of life and health; by providing educational, cultural, and recreational opportunities; and by contributing to national security.

The alternative port systems will be oriented toward accommodating future waterborne commerce for the Bay Region and will be developed as discussed in the following paragraphs.



The first step will be to identify needs from the multiobjectives that are essentially complementary. It will then be possible to combine component needs and elements of a port system to satisfy those needs that are essentially in harmony, the combination representing a nucleus for an alternative port system. At this step, all relevant alternative means of meeting each of the component needs to be included in an alternative port system will be identified and considered. An analysis will be made for each alternative means, including an identification of the beneficial and adverse consequences to the other component needs.

The second step will be the formulation of alternative port systems, building upon the set of complementary component needs and plan elements developed previously. In formulating a given alternative port system, initial consideration will be given to the degree it fulfills the component needs for one of the multiobjectives. Further additions will be made to fill the component needs of other multiobjectives, provided that their addition to a given port system does not significantly diminish the contributions of the overall port system plan to the multiobjective toward which the plan is directed. A benefits and detriments analysis will reveal the extent of any shortfalls with respect to the other multiobjectives. The process will be repeated until sufficient numbers of alternative port systems have been formulated so that there will be at least one plan that generally will satisfy each specified component need of the multiobjectives. A given alternative port system, thus formulated, may satisfy the component needs of several multiobjectives. Portions of port systems will be adjusted to minimize conflicts between the component needs within multiobjectives.

In formulating alternative port systems, tests of acceptability, effectiveness, efficiency and completeness will be applied. The acceptability test refers to the workability and viability of the port system in the sense of acceptance by the public and compatibility with known institutional constraints. The effectiveness test refers to technical performance of the port system and the level of contribution to the components of the multiobjectives. The efficiency test requires that among all acceptable alternatives, the given alternative port system should be the least costly considering all costs required to meet the multiobjectives. The completeness test requires that all investments necessary for the full realization of the specified multiobjectives be accounted for.

At the completion of the selection of port systems phase of the study, study findings up to that point will be presented at one or more public meetings. Comments from all sources will be submitted to the study analysis groups for evaluation, after which further analysis of the selected alternative port systems will be undertaken.

5. Evaluation of Alternative Port Systems. This phase of the study will be undertaken after the selected alternative port systems have been reanalyzed by the six study analysis groups. The primary purposes of this study phase are (a) to reduce the number of alternative port systems so that each remaining alternative port system would be the most efficient to achieve given component needs and would be significantly different from other alternatives in terms of emphasis on multiobjectives, and (b) to repeat the plan formulation process or modify certain steps in that process, if necessary.

This phase of the study involves the evaluation and comparison of the alternative port systems to make the following determinations:

a. The performance of given alternative port systems. That is, how well an alternative port system serves the component needs of the multiobjective used in its formulation. The analysis will include an appraisal of any shortfalls against component needs for which the plan was formulated and the extent of shortfalls against other multiobjective needs.

b. The differences among alternative port systems. That is, how does one port system compare with others in terms of their contributions to the multiobjectives. These comparisons will portray the differences among alternative port systems for which guidelines will be prepared for future navigation development of the Bay Region. The comparisons will include a display of costs and benefits, both monetary and non-monetary, for each alternative port system.

c. The relative values of those benefits and costs that are presented in non-monetary terms. This analysis involves extracting information from previous evaluations in the comparison of alternative port systems. For a given level of waterborne commerce, an alternative port system that emphasizes the national economic development objective is compared with the alternative port systems that emphasize the environmental and social well-being objectives. Enhancement of environmental quality, for example, can be related to benefits foregone or increased cost in national economic development. Similar comparisons between alternative port systems for other given levels of waterborne commerce will yield an array for the non-monetary effects.

The evaluation of alternative port systems will, with other study analyses, consider: Federal, State, and local regulatory constraints; ordinances of local jurisdictions; and, long range master plans of local interests. These plans will be pertinent in considering national efficiency, regional environmental and regional well-being factors.

6. Technical Memoranda. Each of the study analyses will be presented in the form of a technical memorandum.

The drafts of the final report will be submitted to interested parties for comment and public hearings will be held.

7. Guidelines for Navigation Facility Planning. The output of the study will be a series of guidelines or policy statements reflecting the findings of the range of resultant alternative port systems. The final report presenting the guidelines will not recommend any single navigation plan for the San Francisco Bay Region, but rather it will present a number of alternative port systems to meet given level of waterborne commerce, considering the San Francisco Bay Region port complex as a single navigation system. The resultant alternative port systems will differ significantly, primarily in emphasis on multiobjectives, and each alternative port system will be the most efficient to achieve a given set of component needs. Guidelines for each of the alternative port systems will be presented with sufficient detail so that they may be easily translated into an action program.

#### EXISTING NAVIGATION DEVELOPMENT

During 1968 the waterborne commerce of the San Francisco Bay and Delta port complex totalled approximately 52,000,000 tons or about 23 percent of the West Coast ports (including Hawaii and Alaska) or about 4 percent of the total for the United States. Comparative waterborne commerce tonnage for the United States, West Coast and the Bay and Delta Region is shown in Figure 1 for the period 1950-1968. Petroleum and liquid bulk products are the major items of waterborne commerce in the Bay and Delta Region. Over 40,000,000 tons of petroleum and liquid bulk products passed through ports of the Bay and Delta complex in 1968. This represents about 75 percent of the total waterborne commerce of the Bay and Delta Region. The recent development in the movement of waterborne general cargo by containers is a trend which is expected to accelerate in the future. Although the total volume of containerized cargo is relatively small, about 5 million tons at present, it is expected to increase tremendously with the completion of planned container facilities. The Port of Oakland, with 12 container berths in operation, is one of the leading container ports in the world. A breakdown of Bay and Delta Region waterborne commerce by major commodity groups is shown in Figure 2 for the period 1950-1968. Comparable data for the United States and the West Coast ports are shown in Figures 3 and 4.



Commercial ports within the Bay and Delta port complex are located at Redwood City, San Francisco, Oakland, Richmond, Benicia, Stockton, and Sacramento. Location of these ports is shown on Plate 1. Numerous private terminals and harbor facilities are located throughout the port complex, including the petroleum transfer docks and wharves along the shores of San Pablo Bay and Mare Island Strait, Carquinez Strait and Suisun Bay. Shallow-draft facilities are located at San Rafael Creek, Petaluma River, and Napa River, tributaries to San Pablo Bay; Sacramento River; and, Mokelumne River, Old River, and Middle River, tributaries to the San Joaquin River. Landward, these ports and terminal facilities serve primarily the States of California, Nevada, Arizona, Utah and Colorado. Seaward, they primarily serve Alaska, Hawaii, Washington, Oregon, Texas, and the Gulf States, Florida, Canada, British Guiana, Europe, the Far East and Asia.

The commercial ports and numerous other public and private harbor facilities of the Bay-Delta complex are served by approximately 160 miles of Federally-constructed and maintained navigation channels. About 80 percent of the Federal channels are dredged to depths in excess of 30 feet, with the greatest depth under maintenance being the 50-foot entrance channel across the San Francisco Bar just offshore of the Golden Gate. Under existing authorizations, approximately 100 miles of the connecting channels are to be improved and maintained to depths in the 35-55 foot range. Existing terminal facilities include approximately 190 berths and 2,000 acres of supporting cargo handling area. Excluded is a substantial proportion of terminal facilities which are inadequate or substandard and require extensive modification to meet contemporary shipping requirements. Modernization of some of the substandard facilities is underway.

The largest vessels calling on the Bay-Delta port complex, in terms of required draft, are the tankers in the 70,000 to 80,000 deadweight ton class. These vessels enter the Bar Channel at high tide, anchor at deep waters inside the Bay and lighter into smaller tankers that are capable of negotiating the shallower interior channels to complete the journey to the refinery docking facilities.

Through 1968, the Federal cost of navigation improvements in the Bay-Delta port complex amounted to about \$62,000,000 for construction and about \$55,000,000 for maintenance. Existing navigation development and pertinent data for the individual ports and terminals are shown on Table 4.

A sub-regional navigation project for a deepwater channel from San Francisco Bay to Stockton, California (John E. Baldwin and Stockton Ship Channels) has been authorized by the 1965 River

and Harbor Act, as set forth in House Document 208, 89th Congress, 1st Session. This project includes the modification of the existing San Francisco Harbor, Richmond Harbor, San Pablo Bay and Mare Island Strait, Suisun Bay Channel and San Joaquin navigation projects to provide depths of 55 feet for the San Francisco Bar Channel, 45 feet for the main internal Bay channels upstream to the vicinity of Pittsburg, and 35 feet from Pittsburg to Stockton. It also includes the enlargement and deepening to 45 feet of the maneuvering areas adjacent to major petroleum refinery terminals along the channel route, widening the Suisun Bay Channel, providing access and turning basin facilities for a potential harbor in the vicinity of Antioch, and constructing a cut-off route to Stockton through False River and across certain Delta tracts.

#### PERTINENT REGIONAL REPORTS

Federal agencies, the State of California, regional and local agencies, and regional educational institutions have collected and published data and reports concerning the San Francisco Bay Area water related development for many years. The principal water development agencies and the University of California maintain libraries and extensive collections of basic data and records. Federal reports pertinent to the In-Depth Study are: (1) Technical Report on Barriers, San Francisco Bay and Tributaries, completed by the Corps of Engineers in 1963; (2) San Francisco Bay and Sacramento-San Joaquin Delta Water Quality and Waste Disposal Study, currently underway by the Corps of Engineers; and (3) San Francisco Bay Region Environment and Resources Planning Study currently underway by the Department of Housing and Urban Development and the Department of the Interior. The Federal-State Framework Study for the California Region, is also of importance to the In-Depth Study, particularly those aspects on navigation and economic base projections. The State of California, through its Resources Control Board, is conducting a water quality control program for the San Francisco Bay and Delta Region. The primary regional agencies involved with this In-Depth Study are the Association of Bay Area Governments (ABAG) and the San Francisco Bay Conservation and Development Commission (BCDC).

The Corps of Engineers Technical Report on Barriers, the forerunner of studies dealing with problems of regional scope, was completed in July 1963. Although the main purpose of this report was to determine the relative merits of various barriers as alternative means for the transfer of water across the Delta from northern to southern California, data provided by this study on the problems of salinity intrusion, sedimentation, effects of tideland reclamation

on the ecology and regimen of the Bay, water quality and pollution, and population and related growth have led concerned State, regional and local agencies to undertake studies dealing with these problems of the Bay Region. Of special interest to the In-Depth Study are the basic data contained in the Navigation Appendix to the Technical Report on Barriers.

The Corps of Engineers Bay and Delta water quality and waste disposal investigation will be conducted to formulate a water quality management program to maintain and enhance the water quality of the Bay-Delta Estuary. It shares several features with the In-Depth Study, the most apparent of which is an inherent geographical similarity of the primary regional boundaries, i.e., the 12 Bay-Delta Counties. The two studies will require a survey of the existing environmental status of the Bay estuarine system and information obtained by one study may be utilized by the other, providing a more comprehensive analysis and avoiding duplication of efforts for both.

The San Francisco Bay Region Environment and Resources Planning Study is a research and demonstration study currently being conducted by the Office of Research and Technology of the Department of Housing and Urban Development, and the U.S. Geological Survey of the Department of the Interior. This study addresses the need to improve the understanding of the physical environment - its hazards, constraints, opportunities and effects upon man and his community - and to improve regional planning techniques. This study emphasizes the disciplines of geology, pure physics, hydrology and topography and the pertinence and application of these disciplines to improve regional urban planning and decision making. It is anticipated that this study will provide valuable data to the Environmental and Social-Well-Being Analyses of the In-Depth Study.

The California Region Framework Study is a cooperative effort of Federal and State agencies to formulate framework plans to provide a broad guide to the best use, or combination of uses, of water and related land resources of the region to meet foreseeable short and long term needs. The area of investigation includes the State of California and a portion of the State of Oregon included in the drainage basins of the Smith and Klamath Rivers and Goose Lake. For report and analysis purposes, the California Region was divided into 11 subregions. The primary area of investigation for the In-Depth Study, that is, the 12 Bay and Delta counties, is within the San Francisco Bay and Delta-Central Sierra Subregions of the Framework Study. The Framework Study consists of a main report and 18 technical appendices. Of particular interest and usefulness to the In-Depth Study are the Navigation Appendix and the Economic Base Projections Appendix. The California Region Framework Study was initiated in 1967 and the final report is scheduled for completion in 1971.



The San Francisco Bay-Delta Water Quality Control Program was created by the State Legislature in 1965. Its purpose was to determine the need for, and the feasibility of, a comprehensive waste collection and disposal system serving the Bay-Delta area, as well as other measures for the maintenance of the quality of the waters. In addition, it was to develop the basic features of a comprehensive plan for the control of water pollution. This study was conducted by the firm of Kaiser Engineers for the State Water Resources Control Board. This report with findings, conclusions and recommendations was published in final form in June 1969. As a followup to the recommendations of the 1969 report, the State of California is currently conducting studies on toxicity, biostimulation and dispersion of the Bay and Delta waters. These studies will contribute valuable water quality data to the In-Depth Study.

The Association of Bay Area Governments (ABAG) has recently (July 1970) developed and approved a regional plan which specifies major advisory policies and directives for the physical development and spatial distribution of regional facilities involving residential, commercial, industrial, and open space development, environmental quality controls, and regional transportation. The transportation aspects of the ABAG plan reflect the primary findings of the Bay Area Transportation Report produced in June 1969 by the Bay Area Transportation Study Commission. In August 1970, Phase I of a two-phase report entitled "Regional Airports System Study" was published by ABAG. The Phase I study, covering the period 1970-1985, deals with inventory of airport and airspace capacity, airport access, and aviation forecasts to determine future aviation requirements. The Phase II report, underway recently, will involve the balancing of the aviation requirements with regional goals and criteria and to attempt to select alternatives that would respond to a wide spectrum of public concern, particularly in the environment aspects associated with noise, land use and air pollution. The recently established Metropolitan Transportation Commission which replaces the former Bay Area Transportation Commission will direct the development of a coordinated Bay Area Transportation system and will produce a new regional transportation plan by 1973. It is expected that these studies will provide much useful data to the In-Depth Study, particularly the phase on Transportation Systems Analysis.

The San Francisco Bay Conservation and Development Commission (BCDC), established by the California Legislature in 1965, has developed a comprehensive plan for the conservation of the water of the Bay and the development of its shoreline in January 1969. Some of the pertinent information contained in the earlier reports by BCDC was derived from previous studies by the Corps of Engineers. These reports formed the basis for tentative planning conclusions

on different aspects of the Bay. BCDC is required to continually develop new information and to update their plan as conditions and the environment dictate. In December 1971, BCDC is required to submit to the State Legislature a better definition of its priorities for uses of land surrounding the Bay waters. The BCDC plan will establish areas of the Bay shoreline in terms of priorities of development and proposals for land acquisition, and also with recommendations for implementation and purchase of critical priority areas. These studies indicate the significant relationship between BCDC and the Corps of Engineers. In order to conform with the requirements established by BCDC, all future navigation plans will have to be developed within the BCDC Bay Plan framework. Consistent with this policy, much of the studies designed for the In-Depth Study are intended to supplement and provide further definition to the existing BCDC plan.

Other planning studies and development concepts are being undertaken by the Sacramento Regional Area Planning Commission, the Sacramento County Planning Commission, and the San Joaquin County Planning Commission. The In-Depth Study will continually analyze these existing and evolving regional studies in coordination with these and other agencies in order that this In-Depth Study will reflect the goals, objectives, and development concepts of the local interests. The existing regional investigations on airport planning, transportation, shoreline development and open space can also be utilized as a base on which to establish major segments of the In-Depth Study.

#### ELEMENTS TO BE ANALYZED

In the conduct of all investigations, maximum use will be made of existing information and studies underway or under separate authorities in participating agencies. Work will be limited to the amount and degree of refinement needed to reach the objective of the study. The elements to be analyzed are as follows:

1. Commodity Flow Analysis. This study will analyze trade and marketing factors affecting the shipment of commodities through the San Francisco Bay Area. Current levels of waterborne commerce will be determined and information provided for estimating levels that can be expected in the future.

The objective of the study will be to evaluate the potential volume and distribution of commodity flow and the resultant weight and value of waterborne cargo. A probable range of projections based on expected future trade patterns will be presented for significant commodities. Factors that will be taken into explicit consideration are: levels of Gross National Product, regional product output, anticipated consumption patterns, international

trade policies, and the potential for exploiting new technologies and resources. Individual commodities will be consolidated into four cargo categories: (1) petroleum and liquid bulk cargo, (2) dry bulk cargo, (3) general cargo, and (4) containerized and LASH cargo. Commodity flow projections will provide the basis for evaluating facility requirements and various effects of alternate levels of port activity.

The scope of the study will be concerned primarily with existing and future commodity flow through the San Francisco Bay Region and its tributary area. Data of international and national scope will be developed and analyzed to the extent necessary to substantiate regional projections of waterborne commerce. Basic data on world trade will be derived from United Nations sources. Primary information on the origin and destination of commodity flow through and within the region will be obtained by intensifying a nationwide sample survey in preparation by the Bureau of Census. The potential distribution of commodity flow through the West Coast will be derived from a special transportation, cost, and location study. Projections of potential production and consumption patterns of the region and its tributary area will be based on marketing studies of key commodities in conjunction with input-output models of the Bay Region and 11 western states. Extensive use will be made of projections of population and levels of disposable personal income in trade area economic base studies. Raw material inventories will be developed from existing resource investigations and field sources.

Areas in which existing and future commodity flow will be analyzed include world trade, the Pacific Basin, the West Coast, and the San Francisco Bay Region and its trade relations with the rest of the United States.

a. World Trade. Trends in international trade which affect waterborne commerce in the Nation, the Pacific Coast, and the San Francisco Bay Area will be analyzed in a separate study. A workable model of the world economy which traces international commodity flow has been developed by the United Nations. Trade patterns are delimited by zone and commodity flow data are published annually in World Economic Survey. Constituent nations are grouped into three categories: (1) underdeveloped economies, (2) planned economies, and (3) market economies. Imports and exports tend to be positively correlated with Gross National Product. Economic projections based on United Nation's data will be used to develop a framework of world production and world trade. The role of waterborne commerce in world trade, and estimates of the potential international flow of imports and exports will be derived from this study.

b. Pacific Basin. A more detailed study will be conducted of trade between port complexes on the West Coast and trade areas rimming the Pacific Ocean, principally Japan, Hong Kong, Taiwan, New



Zealand, Australia, and parts of South America. The study will consist of an analysis of historical trade relations, economic growth, and projected waterborne materials and manufactured products. Emphasis will be given to future trade with Japan because of its rapid rate of development and large contribution to the value and tonnage of waterborne commerce shipped through West Coast ports. The Pacific Basin study will include an evaluation of the probable impact of the proposed Asian Common Market on commodity flow. Trade area investigations will consist of:

- (1) A natural resource inventory, including amounts of minerals, lumber, fish and agriculture available for domestic use and export.

- (2) Existing level of development reflected in Gross National Product or gross regional product.

- (3) Projected rate of production based on potential investment and technological advancements in manufacturing and marketing.

- (4) Potential market demands based on projections of population, employment, income and per capita consumption.

- (5) Competitive source of supply.

- (6) Governmental trade policies and controls.

c. United States. The United States' analysis will determine the relationship of the San Francisco Bay Area to the national economy and analyze the existing and potential regional share of U.S. overseas trade. Significant national trends which may affect regional trade will be analyzed, including: changes in the growth pattern of the national economy; changes in U.S. foreign trade; the composition and routing patterns of U.S. commodity flow.

d. West Coast. A comparative trade analysis will be conducted for the San Francisco Bay Area and other major port complexes located on the West Coast including: Southern California, the Columbia River area, Puget Sound, and British Columbia.

- (1) The geographical extent and interrelationship of each port complex, regional economy, and hinterland will be defined.

- (2) The weight and value of existing and future shipments will be estimated including: intraregional movements; coastal transshipments; shipments to other regions of the country and foreign nations.

(3) The investigation will include analyses of the distribution of trade through West Coast ports based on alternative transportation costs and other factors including the existing and potential market of the port tributary areas. The extent to which physical transportation constraints may limit commodity flow will be considered in an evaluation of information from related analyses. An analysis will be included of the impact on commodity flow resulting from the development of a single super-tanker complex on the West Coast.

e. San Francisco Bay Region. The main segment of the study will consist of basic data and projections of the flow of more than 100 commodities shipped through the regional port complex. Individual commodities will be grouped into cargo categories and a range of projections will be presented based on levels of population, employment, income, and per capita demand of individual commodities. Commodity and cargo projections will be aggregated on a regional level. The Corps will provide preliminary estimates of future waterborne commerce based on available data and prevailing economic parameters. Methodologies for the Commodity Flow Analysis are as follows:

(1) Sample survey. Basic data will be obtained from the 1970 National Commodity Flow Sample conducted by the Bureau of the Census under an agreement with the Corps of Engineers and the Department of Transportation. The national sample is entirely in the general cargo category. Of approximately 5,000,000 total shipments through U.S. ports, 30,000 waterborne shipments will be observed in the sample survey. About five percent of the total observations will be in the San Francisco Custom District. This five percent sample represents about forty percent by weight of total Bay Region waterborne commerce. The results of the national sample survey will be evaluated to determine the statistical adequacy of base data for projections of potential regional trade. Because of regional specialization, the cross-section of commodity movements through San Francisco Bay may not be adequate for projection purposes. No provision has been included at the present time for a regional origin and destination survey to supplement the national sample. Regional data from the 1970 survey will be available in mid-1971. These data will be analyzed to determine the need for a supplemental survey in 1972.

(2) Bulk commodity market survey. A separate market survey will be conducted of bulk commodities moved through the San Francisco Bay port system. Bulk cargo is not included in the national origin and destination sample survey. Detailed data will be collected because of the significance of large bulk movements in this region, particularly petroleum and agricultural products, e.g., sugar, rice, feed grains and pelletized hay. The bulk commodity survey will include an historical analysis of shipments, definition of service area, and analysis of

growth in the consumption of industry products. Projections of bulk cargo flows will reflect prospective growth in per capita consumption in the service area, projected changes in the sources of supply and estimated expansion of production facilities.

(3) Projections of commodity flow. A range of projections will be developed based on (1) regional growth factors (e.g. population, disposable personal income), and (2) external trade factors reflected in commodity price (e.g. production costs, transportation costs). Interregional trade models will be developed to trace existing and project future commodity flow. The widely used technique of input-output analysis quantifies in dollar amounts the interindustry transactions of national or regional economies. The input-output analysis will evaluate interindustry relationships and ensure that cargo projections are consistent with projections of regional growth. This technique has never been applied to regional navigation studies and will be a prototype. Crude input-output models using 1963 as a base year have been developed in the study area under interagency and University auspices. A 21-sector table of the eleven western States was completed recently to evaluate water requirements. A 14-sector table was constructed to estimate waste loads in the nine counties of the San Francisco Bay Region. These tables will be updated and expanded to include additional sectors for the purpose of measuring commodity flow. Dollar values will be converted to tonnages and industries expected to make greater use of waterborne cargo will be identified. Output projections associated with these models will permit the elaboration of the effect of expansion or contraction of waterborne commerce on Gross National Product, gross regional product, and the balance of trade. Multiplier effects of employment and income on primary and support activities related to shipping can likewise be elaborated. Commodity flow projections based upon sample data and trade and transportation analyses will be reviewed in the light of trends in import quotas, resource exploitation, and anticipated changes in techniques of extraction, manufacture, and marketing.

2. Vessels and Port Facilities Analysis. This study analysis includes all factors, existing and potential, concerning vessels, navigation channels, port facilities and independent or special docking facilities with primary storage areas.

The objective of the Vessels and Port Facilities Analysis is to provide general design and cost estimates for port and terminal facilities to be used during the selection and evaluation of alternative port systems.



The scope of the Vessels and Port Facilities Analysis will be concentrated on the San Francisco Bay Region, but will include, to a lesser degree of detail, major port facilities along the West Coast such as those at Seattle, Portland, Humboldt Bay, Los Angeles-Long Beach and deepwater sites for new harbors. Existing and potential new ports within the Bay Region will be examined and different scales of development will be developed to serve as component parts of alternative port systems. On the near-term basis, this analysis will utilize plans and concepts developed by local agencies. Most existing ports have development plans covering 5 to 10 years into the future. On the long-term basis, development plans will be based on data furnished by the Commodity Flow Analysis, location studies, other economic parameters, and the principles set forth by the other major study analyses such as environmental and social well-being objectives. The other major West Coast ports will be analyzed for their influence on Bay Region ports, particularly under the condition that a potential deepwater super-ship terminal would be located within one of these external ports to serve the entire West Coast.

The Vessels and Port Facilities Analysis will be comprised of three phases of development. The initial phase will consist of preliminary general designs of potential regional port and terminal facilities. The second phase will consist of specific studies on vessels, navigation channels, port facilities, and independent or centralized docking facilities. The final phase of this analysis will consist of summary studies which will consolidate data from specific analyses of the second phase in a format that will be useful for the selection and evaluation of alternative port systems.

The initial phase of the analysis will provide preliminary general plans of port facilities based on available data to meet the preliminary estimates of waterborne commerce. The purpose of this preliminary input, similar to those provided by other major study analyses, is to provide, early in the study, a general framework of vessels and port facilities as a means of initiating the study. The approach for this initial input will be to examine the existing ports and potential new port sites for their full potential physical capability, unrestrained by other potential complications. These plans will be in four categories: conventional facilities; land-side central terminals; offshore terminals; and, a ship-to-ship terminal. Further, general plans within each category will be by several scales of development.

The second phase of the Vessels and Port Facilities Analysis will undertake the specific investigations on vessels, navigation channels, port facilities, and independent docking facilities. Findings of these specific studies, together with principles established for the other major study analyses, will provide the basic

data for refinement of the preliminary inputs of the initial phase of this analysis. These individual specific studies are discussed in the following paragraphs.

a. Vessels. Analyses of vessels will be undertaken giving consideration to supercarriers (petroleum, liquid-bulk products and dry bulk), standard carriers (bulk and general cargo), unit carriers (container, LASH, etc.), barges and passenger carriers. Available data indicates that cargo carriers ranging upwards of 300,000 deadweight tons should be considered. An inventory of existing, planned, under construction, and potential worldwide (by national flag categories), coastal and internal cargo carriers will serve as the basis for the following investigations:

- (1) The development of trends in vessel features (physical, manpower, capacity, etc.), vessel maneuvering requirements, and vessel investment and economic factors.

- (2) A summary of existing legal and institutional factors associated with current vessel operations and construction and the compatibility of such factors with vessel trends.

b. Navigation Channels. Analyses of navigation channels will be undertaken which can permit the passage of vessel trends found pertinent from the preceding investigation. Available data indicates that navigation channels, existing or potential, which permit passage of a vessel with a draft of more than 30 feet are pertinent to the future of waterborne commerce in the San Francisco Bay Region and the compatibility and competitiveness of the region to other areas of the United States. The maximum compatibility of navigation channels with ecological and environmental objectives is critical. An inventory of navigation channels (existing, authorized, or under study) within the United States providing for vessels of draft of 30 feet or more will serve as a basis for the following investigations:

- (1) A factor evaluation of potential navigation channels along the West Coast, exclusive of the San Francisco Bay Region, which are competitive with potential regional navigation channels.

- (2) An inventory evaluation of all navigation channels (existing, authorized, or under study) in the San Francisco Bay Region.

- (3) An engineering and related first cost analysis of potential navigation channels in the San Francisco Bay Region. Potential guidance is to be provided by findings of the vessels

and port facilities investigations. Disposal programs for excess materials are to be governed by the Environmental Analysis findings. Aids-to-navigation are part of the analysis.

(4) An engineering and related first cost analysis of environmental mitigation and/or enhancement measures associated with potential navigation channels.

(5) An evaluation of potential navigation channel maintenance factors, operation procedures and related annual costs.

(6) A summary of existing legal and institutional factors pertinent to regional navigation channels and the compatibility of such factors with potential channels.

c. Port Facilities. Detailed analyses of existing and potential port facilities within the San Francisco Bay Region will be undertaken based on accommodating vessel trends and commodity flow findings. Evaluation of dockside facilities and supporting operating areas will be made giving consideration to all factors associated with existing developments, modernization potential, expansion potential, and the potential of new ports. Existing port areas subject to evaluation are: San Francisco, Redwood City, Oakland, Richmond, Stockton, Sacramento and Benicia. Available data indicate that new ports might be located at Collinsville and Antioch. Major inter-related coastal harbors adjacent to the region are Crescent City and Humboldt Bay and a potential development at Moss Landing. Available data indicate that this area of investigations will encompass the majority of investigations on containerized and LASH modes of water transport and potential centralized dry bulk facilities. An inventory of existing, authorized, and planned modernization and/or expansion programs for port facilities and supporting areas in the San Francisco Bay Region, including estimated investment and economic factors, will serve as a basis for the following investigations:

(1) An evaluation of the capabilities of existing, authorized, and currently planned port facilities and supporting areas to accommodate study findings on vessels, commodity flow and transocean passenger flow. Supporting service facilities to all aspects of water transportation will be included.

(2) An engineering, investment and economic factor analysis of potential port facilities and support areas, including new ports and centralized terminals, which will meet the requirements of study findings on vessels, commodity flow and transocean passenger flow. New technology, including intermodal factors, will be thoroughly considered in this analysis.



(3) An engineering and investment analysis of the mitigation and/or enhancement measures associated with authorized, currently planned, and potential port facilities and supporting areas to meet environmental and social well-being objectives.

(4) A summary of existing legal and institutional factors pertinent to San Francisco Bay Region port facilities and supporting areas and the compatibility of such factors with potential developments.

d. Independent or Centralized Docking Facilities. Detailed analyses will be made of existing and potential individual docking facilities and primary storage areas along existing and potential navigation channels of the San Francisco Bay Region. Such facilities, primarily, lead directly to industries handling materials and products requiring water transport. Within the San Francisco Bay Region, these types of developments are essentially located on the east side of San Pablo Bay, Carquinez Strait, Suisun Bay Channel and Napa River. Barge channels are included. Detailed analyses will also be made of centralized docking facilities, all of which are potential to the San Francisco Bay Region. Various plans, State and local, give consideration to conceptual central terminals on land, in bay-waters, and in coastal-waters for liquid bulks. These plans reflect the potential of supercarriers compatible with minimum disturbance of the environment. Projections in technical publications indicate that dry bulk and other cargoes might also be advantageously transported through central terminals. Also, analysis will be made of the potential of locating a centralized liquid bulk terminal in other external major coastal ports that could serve the entire West Coast. An inventory of the existing, authorized, and currently planned independent docking facilities and primary storage areas in the San Francisco Bay Region, including estimated investment and economic factors, will serve as a basis for the following investigations:

(1) A regional evaluation of the capabilities of the inventorized independent docking facilities and primary storage areas toward accommodating study findings on vessels and commodity flow.

(2) An engineering, investment and economic analysis of additional potential independent docking facilities and primary storage areas in the San Francisco Bay Region required to meet the findings of vessel trends and commodity flow.

(3) An engineering, investment and economic analysis of central docking facilities and primary storage areas (land, bay-waters, and coastal waters) in the San Francisco Bay Region, that

when combined with existing and planned independent docks, will meet the findings of vessel trends and commodity flow. Locations will be significantly influenced by results of navigation channel studies, environmental objectives and social well-being objectives.

(4) A conceptual evaluation of the potential of bulk cargo docking facilities along the West Coast outside of the San Francisco Bay Region.

(5) An engineering and investment analysis of the mitigation and/or enhancement measures associated with authorized, currently planned, and potential independent and centralized docking facilities and primary support areas to meet environmental and social well-being objectives. Facility designs to minimize potential hazard from oil spill will be of major importance.

(6) A summary of existing legal and institutional factors pertinent to San Francisco Bay Region independent and centralized docking facilities with primary supporting areas and the compatibility of such factors with potential developments.

The final phase of the Vessel and Port Facilities Analysis will consist of summary studies of economic factors associated with authorized, currently planned, and potential navigation channels, port facilities, and independent and centralized docking facilities with associated primary supporting areas. These analyses are to be oriented toward investment and economic factors related to movement of waterborne cargo tonnage. This phase of the analysis will also develop the different scales of development for existing and potential port and terminal facilities to provide the component parts during selection and evaluation of alternative port systems to meet given levels of waterborne commerce, together with the environmental and social well-being implications.

3. Transportation Systems Analysis. This study area concerns the present and potential factors of all land and air transportation systems (rail, highway, air, and pipeline) which are related to the San Francisco Bay Region port systems.

The objectives of the Transportation Systems Analysis are to determine the probable influence of future developments in waterborne commerce and port facilities on the existing and future developments of the integrally related elements of the regional transportation system, including land, water and air transport; and to formulate principles to serve as guidelines for developments in navigation that will help to establish intermodality in which all elements are optimally coordinated and developed.

The scope of the Transportation Systems Analysis includes the investigation of all land and air transportation systems which may influence the San Francisco Bay region and port systems. Interport, interregional, and national transportation demands, as well as the resulting physical and economic operations, will be analyzed in relation to the various levels of commerce and possible alternative development concepts for the San Francisco Bay Region. A primary concern of this investigation will be the analysis of transportation in terms of a totally integrated system. Although water transportation is analyzed under the Vessels and Port Facilities, the physical and economic factors of the existing and projected intermodal aspects of all land, air and water transportation will be analyzed.

a. Railway Transportation. Analysis of railways will consider the physical facilities required and economic considerations necessary for the transport, transfer, storage, and handling of various commodities involving those railway networks influencing the San Francisco Bay Region. The major rail networks involving the entire West Coast will be analyzed in relation to possible alternative routes and ports for various commodity movements. Analyses will be formulated upon current inventories of primary and secondary rail networks of the West Coast. Route locations, present maximum operating capacities, general condition of facilities, maintenance requirements, and volume of cargo movements between various segments of each rail network will be established. (Volume of rail traffic between cities of the West Coast area such as Salt Lake City to San Francisco, Salt Lake City to Los Angeles, or Seattle to San Francisco, will also be analyzed.)

Inventories of plans for development, expansion, or improvement of overall rail networks and facilities will help to establish guidelines for possible rail facilities in terms of existing and proposed land and facilities needed for expansion or improvements associated with various development alternatives and levels of commerce established by commodity flow factors. Investigations will concern the following:

- (1) Review and analysis of existing San Francisco Bay Area transportation and land use plans to establish the adequacy of present plans to accommodate the rail traffic and supporting rail facilities associated with various alternative development concepts and levels of commerce for the Bay Area derived from Commodity Flow Studies.

- (2) Analysis of the compatibility of existing regional transportation and land use plans with the various development alternatives concerning rail transportation requirements.



(3) Analysis of railways in intermodal transportation operations to establish the operational capabilities, capacities, efficiency, and facilities involved in present rail intermodal operations related to vessels and port facilities, air transport, and highway transport operations.

(4) An analysis of the planned expansion and upgrading or railway facilities and operations necessary to increase intermodal rail capabilities for various levels of commodity movement in the San Francisco Bay Region.

(5) An analysis of the possible technological innovations in rail equipment and operations, and the factors influencing rail industry adoption of innovation concerning possible physical and economic aspects of intermodal transportation. Also, concepts such as the "Land-Sea Bridge" system and the "Unit Train" will be analyzed.

(6) An economic factor analysis (design, cost estimates, investment, etc.) associated with expansion and/or improvement of railway operations, facilities and intermodal capabilities necessary to meet various levels of commerce as well as specified environmental and social well-being objectives.

(7) An analysis of the existing legal and institutional factors influencing railway operations. Analyses concern regulatory procedures that would increase all levels of rail and intermodal transportation efficiency.

b. Highway Transportation. Analyses of highway transportation will consider those physical and economic factors influencing the design, location and capacity of existing and planned highway networks serving the San Francisco Bay Region. An analysis of the major highway networks, including the interstate system, of the entire West Coast will be conducted in relation to possible alternative routes and ports for various commodity movements. Analysis of motor carrier transportation will consider the physical, institutional, and economic factors related to present and future operations. Analyses will be formulated upon current inventories of major arterial and interstate highway systems serving the West Coast. Route locations, maximum operating capacities, with constraining influences, maintenance requirements, and traffic volume generated on major segments of each network will be established.

Inventories of programs and plans for additions, expansions, or improvements of major highway systems within the entire study area will be used to establish the capability for these developments to meet demands generated by the various levels of commerce established by commodity flow determinants. Investigations will concern the following:

(1) Review and analysis of existing San Francisco Bay regional transportation and land use plans to establish the adequacy of present highway plans to accommodate the expected volume of traffic associated with the various levels of commerce derived from commodity flow studies for the San Francisco Bay Region.

(2) Analysis of the compatibility of existing regional transportation and land use plans with the various development alternatives concerning highway transportation requirements.

(3) Analysis of highway and motor carrier transport in intermodal transportation operations to establish the operational capabilities, capacities, efficiency, and facilities involved in present motor carrier intermodal operations related to vessels and port facilities, air transport, and railway transportation.

(4) An analysis of the planned expansion and upgrading of highways and motor carrier equipment, facilities, and operations necessary to increase motor carrier intermodal capabilities related to the alternative development concepts and the various levels of commodity movement in the San Francisco Bay Region.

(5) An analysis of the possible technological innovations in highway design and construction, motor carrier equipment, facilities, and operations, and the factors influencing the motor carrier industry adoption of innovations concerning all the physical and economic aspects of intermodal transportation.

(6) An economic factor analysis associated with expansion and/or improvement of motor carrier operations, storage or related handling facilities, and intermodal capabilities including those necessary to meet specified environmental and social well-being objectives as well as the various levels of commerce.

(7) An analysis of the present legal and institutional factors influencing all aspects of motor carrier operations. Analyses are involved with possible recommendations concerning regulatory procedures that could increase all levels of motor carrier and intermodal transportation efficiency.

c. Air Transportation. Analyses of air transportation will consider the present and planned airport networks within the San Francisco Bay Region. Analyses will primarily concern present and future cargo capacities, physical and economic factors involving expansion and improvement of facilities, and present and potential types and volume of cargo susceptible to air

transport in the San Francisco Bay Region. (Historically, air cargo and related facilities and operations have been structured upon systems designed almost exclusively to accommodate passenger volumes rather than cargo. As a result, future air cargo trends and capacities will require the consideration of air cargo in relation to future air passenger requirements.) Analyses will be formulated upon current inventories of existing airports and direct supporting facilities within the San Francisco Bay Region. Classification of air facilities (local, regional, international, military, private, etc.) should indicate flight paths, aircraft approach zones with corresponding height and width restrictions, and adjacent areas zoned according to direct airport and hazard influence. Also, the physical relationship between airport facilities and highway, railway, and port facilities connections influenced by airport related facilities should be indicated. Inventories of the existing and projected passenger and cargo capacities of each airport in the San Francisco Bay Region as well as programs and plans for improvements, additions, or expansions of airports and supporting facilities within the entire study area will be used to determine the capability for these developments to meet demands generated by the various levels of commerce established by commodity flow determinants. Investigations will concern the following:

- (1) Review and analysis of existing San Francisco Bay regional transportation, airport, and land use plans to establish the adequacy of existing airport plans to accommodate the anticipated volume of air traffic associated with the various levels of commerce derived from commodity flow studies for the San Francisco Bay Region.

- (2) Analysis of the compatibility of existing regional airport, transportation, and land use plans with the various development alternatives concerning air transportation requirements.

- (3) Analyses of aircraft and airport facilities in intermodal transportation operations to establish the operational capabilities, capacities, efficiency, and facilities involved in present air cargo intermodal operations (primarily containerization) related to railway, highway, and port-related transportation.

- (4) An analysis of the possible technological innovations in cargo-related aircraft design, supporting facilities, equipment, and operations, and the factors influencing the aircraft industry adoption of innovations concerning all the physical and economic aspects of intermodal transportation.



(5) An economic factor analysis associated with expansion and/or improvement of air cargo and passenger operations, storage or related handling facilities, and intermodal capabilities, including those necessary to meet specified environmental and social well-being objectives as well as the various levels of commerce and related passenger volumes.

(6) An analysis of the present legal and institutional factors influencing all aspects of air transportation. Analyses are involved with possible recommendations concerning regulatory procedures that could increase all levels of air and intermodal transportation efficiency.

d. Pipeline Transportation. Analyses of pipeline transportation will consider the present and planned major pipeline networks that may influence commodity movements for the entire West Coast (including Canada and Alaska). Intensive investigations in the San Francisco Bay Region will involve all physical, economic, and environmental factors influencing existing and planned pipeline operations. Analyses will be formulated upon current inventories of national or international existing and proposed pipeline operations and supporting facilities that may influence transportation requirements within the San Francisco Bay Region. Inventories should also include origin, intermediate supply and release points, capacities of each segment of the networks, and destination of all pipelines (including the trans-Alaska pipeline) which may influence transportation requirements on the West Coast.

Inventories of existing or planned pipeline operations in the San Francisco Bay Region indicating route locations, areas needed for storage, and required supporting facilities will help to establish guidelines for possible pipeline operations in terms of proposed facilities needed for expansion or improvement associated with various alternative development concepts and the levels of commerce related to liquid-bulk pipeline operations derived from commodity flow studies. Investigations will concern the following:

(1) Review of existing regional San Francisco Bay Area plans (transportation, land use, airports) to determine the compatibility of existing plans with alternative development concepts which utilize substantial pipeline operations as a major transportation element. Included in these analyses would be such concepts as the petroleum or liquid-bulk central land-side terminal and/or the "Utility Corridor" concept.

(2) Analysis of the major pipeline operations into and out of the San Francisco Bay Region to establish the physical and economic influences on the development of ports and supporting areas presently utilizing vessels for petroleum and liquid-bulk operations.

(3) An analysis of the optimum location for pipeline terminal(s) in relation to the total regional transportation system and total regional development.

(4) An economic factor analysis associated with the initial cost of establishing major pipeline operations, the long term economics of pipelines compared with other modes of transportation, and the total scope of pipeline operations in relation to meeting specified levels of liquid-bulk commerce as well as certain environmental and social well-being objectives.

(5) An analysis of the present legal and institutional factors influencing all aspects of pipeline transportation. Analyses are involved with possible recommendations concerning regulatory procedures that could increase all levels of pipeline and the resulting general transportation efficiency.

e. Unified Transportation Systems and Intermodal Operations. Analyses of Unified Transportation Systems will consider the overall view of transportation for the entire San Francisco Bay Region in terms of a unified system for each of the various alternative development concepts. This analysis will be concerned with the optimum integration of all the elements to the transportation systems (vessels and ports, highways, railroads, airports, and pipelines) within the objectives and criteria established by the major study items. Investigation subjects will be the following:

(1) The combination, review, and analysis of all intermodal factors associated with investigations on vessels and port facilities, railways, highways, and airport transportation.

(2) Optimum integration of the intermodal factors from each transportation element in relation to various alternative developments for the San Francisco Bay Region.

(3) An economic factor analysis associated with the most efficient unified transportation systems for the total San Francisco Bay Region including those that accomplish specified environmental and social well-being objectives.

(4) Review and analysis of existing regional shoreline, transportation, and land use plans to determine the compatibility of existing plans with those developed for each alternative development concept.\*

\*(Some of the major regional agencies and plans referred to in this study are the following:

.San Francisco Bay Conservation and Development Commission (BCDC) - their goals, objectives, and plans concerning shoreline development.

.Association of Bay Area Governments (ABAG) - their goals, objectives, and plans for total regional growth and their study efforts in areas such as airport planning.

.Metropolitan Transportation Commission (MTC) - their responsibilities and activities concerning mass transit (BART), highways, bridges, and the roles of harbors and airports in the regional system.)

(5) Analyses of the present legal and institutional factors influencing transportation as an overall unified system. Analyses are involved with possible recommendations concerning the regulatory procedures that could increase the operational capacity and overall efficiency of a unified transportation system within the San Francisco Bay Region.

4. Environmental Analysis. This study area includes the analysis of factors, existing and potential, which comprise the diverse, but integrally related, aspects of the environment.

The objective of the environmental analysis is to formulate principles to serve as guidelines for future developments in navigation within the prescribed study region, and to evaluate navigation alternatives for compatibility with these principles.

The scope of the environmental analysis will be concentrated on the primary study area, but will also include adjacent coastal sites of existing and potential harbors (i.e. Moss Landing). The studies of these areas will be in terms of the existing conditions, the potential environmental implications of regional navigation developments and their ultimate effect on the population. Beneficial and detrimental impacts will be analyzed, and all potential modifications, induced by developments associated with regional navigation, will be assessed. In the event of potentially detrimental developments, mitigative measures will also be studied. Multiple-use and multiple-benefit concepts, where applicable, will be considered. Emphasis will be given to the preclusion of developments which would involve the irreversible or irretrievable commitment of natural resources.



A set of summary analyses will be applied to yield a comprehensive assessment of existing and potential environmental conditions. Within these analyses, an environmental evaluation system will be incorporated to assist in the presentation and interpretation of data.

The environmental analysis will utilize existing and ongoing work in related areas to serve as a foundation for study development. Included in this category are: conceptual plans (i.e., San Francisco Bay Conservation and Development Commission studies, Association of Bay Governments studies); specific plans (i.e., individual port plans); specific investigations (i.e., San Francisco Bay and Sacramento-San Joaquin Delta Water Quality and Waste Disposal Investigation, San Francisco Bay Delta Water Quality Control Program); regulatory controls (i.e., Federal and State water quality standards, State Lands Commission, Corps permit procedures).

The environmental analysis will be comprised of three phases of development. The initial phase will concentrate on the establishment of preliminary unrestricted environmental objectives which will serve as framework guidelines for the other study areas. The second phase will concentrate on the pursuit of individual analyses. The final phase will consist of the evaluation and application of the individual analyses to a group of summary analyses which will provide the basis for the establishment of the final environmental objectives.

The initial phase of the environmental study group will be to develop and furnish participants of the other areas of analysis with a set of preliminary environmental objectives. These objectives will be framed from the standpoint of desirable goals and will be unrestricted in their context. They will reflect the most stringent criteria advocated by local, regional, State and Federal interests, and for purposes of reference will also include the less stringent criteria advanced by all interested agencies. Environmental objectives will be formulated for: important natural resources and ecosystems; areas of scenic beauty and aesthetic value; water, land and air quality requirements; dredging requirements, and land use priorities.

The second phase of the Environmental Analysis will include individual analyses on the biota, hydrology, geology, physiography, pedology, and climate of the area under study. These individual analyses are discussed in the following paragraphs.

a. Biota. Detailed analysis of existing and potential levels of viability within the San Francisco Bay Region will be oriented toward ascertaining the requirements for the development and maintenance of a healthy, well-balanced ecosystem. This biome will extend from accessory hinterlands to marshes, mudflats and the estuary

itself. The unique nature of the region with its composition of near-pristine settings, farmlands, suburbs, and a burgeoning megalopolis requires that these studies be extended beyond remote areas of unique interest to include the complete spectrum of the region's biomass. However, as indicated in the summary analyses, areas of unique interest will be delineated. Analysis of vegetation, while not specifically cited, remains as a prerequisite for other studies. Investigation subjects will be:

(1) A general analysis of estuarine ecology as it is affected by present and probable regional modifications of port areas and waterways.

(2) A detailed analysis of project and maintenance dredging and dredge spoil disposal on the migration of anadromous fish, the obliteration of benthic communities and the life cycles of other estuarine species.

(3) A determination and evaluation of the effects of alterations of Bay bottom topography on sediment transport, shoaling rates, and water quality as these relate to fish and wildlife.

(4) An analysis of the impact of developments in vessels, port facilities, and handling procedures on potential spills and the environmental implications of such spills.

b. Hydrology. As the dominant physical feature of the San Francisco Bay Region, the estuary, itself, exerts an unusually strong influence on all other salient aspects of the environment. Therefore, preservation and enhancement of the region's environment can be directly correlated to the preservation and enhancement of its hydrological features, specifically its water quality. Where it has been deemed appropriate, some fundamentally hydrological investigations have been listed under other headings due to the magnitude of their impact in those areas. Investigation subjects will be:

(1) An analysis of modifications in the tidal prism, flow patterns and salinity intrusion related to alterations in channel depths and configurations.

(2) An analysis of the multiple effects of physical modifications for waterborne commerce, increased navigation, and waste disposal on the concentration of pollutants in the estuarine system.

(3) An analysis of the relationship of dredging activities to sediment transport beyond the Golden Gate.

(4) An analysis of spoil disposal within the estuarine system by: placement on dry land; placement as fill in approved fill projects; barging or piping to suitable disposal sites in the ocean; and, dumping in designated disposal sites within the Bay.

(5) A survey of freshwater aquifers within the estuarine system, and an analysis of their potential contamination through dredging operations.

c. Geology. Existing geologic features will be analyzed with regard to the effect of navigation on these resources. Investigation subjects will be:

(1) An inventory of the mineral resources, including salt ponds, shell deposits, sand and gravel, petroleum and natural gas, found within the estuarine system.

(2) An analysis of the effect of navigation developments on these resources.

d. Physiography. Analysis of the region's physiography will investigate current concepts of land use prerequisites, much as they were in the report of the San Francisco Bay Conservation and Development Commission, to determine the most beneficial utilization of the region's land resources from an environmental standpoint. Investigation subjects will be:

(1) An analysis of land use priorities and multiple use concepts of estuarine and riparian lands.

(2) An analysis of alternative approaches to the utilization of land resources, including the relative merits of landfills, pilings, and inland construction.

e. Pedology. An analysis of the various aspects of soil conditions is intended to delineate areas of concern associated with navigation developments. Investigation subjects will include:

(1) Analysis of spoil excavated from harbors and channels as a potential problem from biological and chemical aspects.

(2) An analysis of soil erosion associated with navigation developments.

f. Climate. The intrinsic association of the San Francisco Bay Region's physical, chemical and biological properties and its climatic conditions is well established. Further analysis is required to determine the effect future modifications in waterborne transport may have on this natural resource. Investigation subjects include:



(1) An analysis of potential air pollution attributed to varying degrees and modes of waterborne transport and exchange.

(2) An analysis of modifications in climatic conditions attributed to potential alterations of the estuarine system.

g. Summary Analyses. The summary analyses are not designed as separate items of investigation. Rather they are to be applied to all other individual investigations in an effort to develop a comprehensive assessment of the impact of navigation on the environment. Subject areas include:

(1) An analysis of the environmental implication of proposed developments in waterborne commerce. Included in the analysis will be an assessment of both the direct and indirect consequence of such developments, and, in the case of adverse effects, identification of appropriate protective, remedial and mitigative measures.

(2) An assessment of the environmental effects of all alternatives to the original proposals, including the proposal of no action.

(3) An analysis of the relationship between local short term use and the maintenance and enhancement of long term benefits to the environment. Cumulative effects and, especially, the irreversible or irretrievable commitment of resources will be assessed in terms of their full implication to the environment.

Once the individual analyses have been completed, criteria will be developed to describe or evaluate the beneficial or detrimental effects of the various potential developments. To the extent possible, beneficial and detrimental effects will be displayed in terms of relevant physical or ecological criteria or dimensions, including the appropriate qualitative dimensions. For example, where the effects of a plan will be visibly evident, quantitative and qualitative description may be made in terms of established or accepted water and land classification or ecological criteria and related measures.

However, certain environmental effects can be presented more effectively by reference to their qualitative dimensions. For instance, it may be necessary to use this approach to show the importance of a reduction in use or availability for use of areas of natural beauty. Consequently, the analysis would be supported by an appropriate descriptive-qualitative interpretation and evaluation of the effects of the plan on the relevant components of the environmental objective.

It is not presently possible to anticipate or identify, much less measure, all environmental effects or changes. Nor are there in existence evaluation standards that permit full and direct quantitative comparisons and ranking of the conditions of identifiable environmental effects that might be expected to result from a plan. As a result, reasoned judgments by multidisciplinary teams may be required in many situations. When this is necessary, an expression of the state of knowledge and the limitations thereof, as well as the limitations of the analysis in each instance, is essential.

#### 5. Social Well-Being Analysis.

This study area concerns the diverse yet integrally related sociological aspects of growth and development in the San Francisco Bay Region that may be influenced by port development and the associated activities of waterborne commerce.

The objectives of the Social Well-Being Analysis will be to determine those physical, economic, and cultural aspects of the Bay Area population and environment, together with their inter- and intra-relationships, which are affected by port related activities and developments. Also, the objective of this analysis will be to identify and formulate means of enhancing the overall social well-being of the Bay Region population by considering the personal, group, and area effects of navigation and waterborne commerce activity. Inherent in this analysis are specific objectives such as the following: the security of the life and health of all persons, protecting and enhancing the natural environment, alleviation of unemployment and related socio-economic deprivations, the promotion of economic growth, and social improvement of all groups within the zone of navigation development influence.

The scope of this analysis will include the study of the urban and regional area partly in terms of the physical, spatial, and material aspects of the dynamic regional infrastructure, and partly in relation to the social structure of the region with its concern for human values, behavior patterns, and the framework of social interactions and institutions such as the family, governments, educational systems, and businesses.

The initial phase of the Social Well-Being Analysis will involve the formulation of preliminary social well-being objectives. These objectives will provide initial social well-being parameters for the other major In-Depth Study analyses and will be unrestricted in their context. The formulation of such objectives will reflect criteria advocated by local, regional, State

and Federal interests related to overall social betterment as well as total growth and development. Also, within this initial phase, programs and methodologies will be established with which to measure, evaluate, and implement sociological criteria to be used in the formulation, evaluation, and implementation of guidelines established for navigation developments, and waterborne commerce activities.

The second phase of the Social Well-Being Analysis will encompass four primary interrelated areas of investigation - economics, general welfare, environmental quality, and regulatory controls. The content of each of those analyses will be as follows:

a. Economics. These analyses will involve studies and projections of the various basic and service economic activities of the defined study area. Also, they will identify and formulate the system of linkages within economic activities influencing waterborne commerce and navigation developments. Inherent in the studies will be population, employment, production, and consumption factors related to the economic growth and development of the San Francisco Bay port system. Other areas to be investigated will be the long term changes in the composition of imports and exports and the effect of such changes on port and associated industrial, utility, and transportation facilities developments. These investigations will provide parameters to be used in the preparation of alternative development projections and policy guidelines concerning navigation development and waterborne commerce. Major regional and national economic base studies already available will be utilized as much as possible. Items to be studied will include the following:

(1) Analyses and projections of population, employment, industrial and agricultural production and consumption, and inter- and intra-industry relationships related to navigation and waterborne commerce activities and development.

(2) Analyses of present and future composition of imports and exports in defined areas and the effect of changes in composition on Bay Regional industrial development.

(3) Economic evaluation of the present and possible future role of the San Francisco Bay port system in West Coast, United States, Pacific Basin, and World oceanborne commerce.

(4) Identification of new and expanded industries dependent upon improved navigation facilities.

(5) Determination of projected raw material requirements for the San Francisco Bay Region in relation to industrial growth and projected tonnages of commerce.



(6) Analyses and projections of the production, distribution, and consumption of goods with the necessary service facilities and activities related to the various projected levels of navigation development.

(7) Determination of public costs and anticipated revenues associated with navigation and waterborne commerce developments.

(8) Analysis of land availability and projected space requirements for port developments and related activities in port areas.

(9) Identification and formulation of conditions contributing to the attainment of economic stability of specific, as well as general, geographic areas, groups, and industries.

b. General Welfare. These analyses will determine the effects of developments in navigation and waterborne commerce on the general welfare of the Bay Region population. General welfare refers to those factors and conditions of individuals and groups in terms of human values and behavior patterns as reflected in goals for employment, cultural facilities, patterns for development, the alleviation of socio-economic discrimination and deprivation, and the personal and group health and safety of all residents. The analyses will consider the beneficial and detrimental effects of proposals relating to developments in waterborne commerce and navigation. Items to be studied will include the following:

(1) Determination of mass and group values concerning factors such as employment, educational, and housing opportunities.

(2) Alleviation of economic deprivation of specified areas or groups in relation to the equitable distribution of real income, employment, and general service facilities for the population.

(3) Development of policy guidelines reflecting existing regional goals concerning spatial distribution and the general type of development patterns.

(4) Determination of health and safety criteria in relation to navigation development activity for the general security from local and regional hazards and for national well-being.

(5) Determination of convenience criteria in relation to home-work travel time, cultural facility locations, and industrial operations as related to navigation development activity.

(5) Determination of adverse social consequences of port development and related activities as affecting economic stability, population and employment concentrations, and the displacement of businesses, institutions, and residential areas.

c. Environmental Quality. These studies will involve analyses of the quality of the physical environment of the designated study areas. The objectives for conservation, protection, creation and/or restoration of natural, scenic, and cultural resources necessitate the establishment of methods not only to conserve and enhance natural resources such as rivers, lakes, and beaches, but also areas of archaeological, historical, or scientific value. Objectives and formulated data from the Environmental Analysis and the general welfare section of this analysis concerning pollution control, protection of wildlife systems, and open space regulation will be utilized to reinforce the concept for enhancing the total environment. Items of analysis concerning environmental quality will include the following:

(1) Determination of physical improvements (aesthetic as well as functional) needed to enhance residential, commercial, and industrial areas influenced by port development and waterborne commerce activities.

(2) Determination of the effects of navigation development and related activities on open space, and recreation facility requirements.

(3) Determination of land use compatibility criteria with emphasis on the juxtaposition of residential, industrial, commercial, and recreational areas with present and future port facilities and adjacent support industry.

(4) Coordination of urban renewal and model cities programs related to economic, social, and environmental factors influenced by port development.

(5) Protection of natural resources possibly affected by navigation developments or related activities as related to social well-being objectives.

(6) Inventory of cultural facilities existing or proposed, their location, quality, and purpose in relation to developments in Bay Region navigation.

d. Regulatory Controls. Regulatory controls from all levels of government influence the social, economic, and environmental aspects of navigation development and their related waterborne

commerce activities. This analysis will review those rules and regulations relevant to waterborne commerce activities and determine possible regulatory changes which would optimize all levels of navigation activity efficiency while maintaining the goals and objectives established by economic, general welfare, environmental quality criteria. Items to be studied will include the following:

(1) Inventory and evaluation of regulatory powers of eminent domain, condemnation, and public safety as related to social well-being and navigation developments.

(2) Establishment of design criteria by authorities to guide uniform development and assure compatibility of commercial, industrial, and cultural facilities associated with navigation developments.

(3) Review of sub-division controls, zoning ordinances, and density control factors affected by different levels of port development.

(4) Review of the fiscal capabilities of the various governmental units to initiate and sustain navigation and related developments.

(5) Review of jurisdictional considerations involved in coordinated port development and the associated regional activities concerning waterborne commerce.

(6) Review of public policies at all levels of Government influencing local and regional port development and related activities.

The third phase of the social well-being analysis involves integrating data from the other major In-Depth Study Analysis into the formulation of final social well-being principles as well as providing social well-being criteria to the other major study areas. The broad spectrum of types of sociological data and measurements to be derived and correlated from the economic, general welfare, environmental quality, and regulatory control analyses necessitates the establishment of definitive uniform methods with which to measure, classify, and effectively utilize the heterogeneous sociological data. One possible method suggests that sociological data and measurements be categorized into basically three different types - qualitative/quantitative standards, comparative standards, and independent standards. These three basic types of classification can be utilized to institute the necessary inter- and intra- trade-off analyses and correlations within the social well-being investigation, and between complementary as well as competitive goals and objectives of the other major analyses of the In-Depth Study.



The qualitative/quantitative standards are basically "scientific" factors such as health and safety criteria, population densities, minimum required incomes and so forth established by professionals as standards for general growth or development. Comparative standards are basically factors where no optimum values have been established, but where ranges or boundaries can be established for cross-comparison data relating to factors such as education level per capita, income level of port-related employment, and land use compatibility. Independent standards primarily refer to value systems within the specific social, economic, institutional, and cultural aspects of designated areas and groups concerning such factors as open space, housing types, residential locations, desirable transportation modes and so forth. Such a system of standards will primarily help in establishing sets of activities which will optimize stated goals and establish priorities within and among the various types of sociological criteria affected by navigation development. The resulting methods are used to incorporate qualitative social factors into a system of standards to be used in establishing guidelines for navigation development.

Such sociological standards could help determine the point at which a certain developmental value to the community sufficiently exceeds cost to the community, or possibly conversely, where a developmental value proves far too costly in relation to resources available for growth and development. Such a system will facilitate the establishment of methodologies for estimating the costs of not providing for social improvements as well as the costs and anticipated benefits of achieving the established standards in relation to social goals and objectives. For example, the social costs of certain types of development as reflected or measured in port related land side traffic congestion, uncontrolled sprawl, home dislocations, or other situations, could greatly exceed the social benefits of that development even though a greater range of occupations, goods, housing types, or services could be provided. As a result, within this framework of measured social criteria and established standards, the social effects of development, whether beneficial or detrimental, are analyzed, measured in dollar expenditures, and compared to present and future monetary resources associated with waterborne commerce activity. Operational targets are then set and implementation procedures are established which reflect sociological goals and objectives to be considered within the assessment of alternatives and the formulation of guidelines established for waterborne commerce and navigation development.

6. National Defense Analysis. The objective of this analysis is to determine role and requirements for national defense of the San Francisco Bay port system under existing and future conditions of waterborne commerce and port developments.

The scope of this investigation will include an analysis of the national defense network with primary focus on the San Francisco Bay port system. Investigations to be conducted will concern individual port area analyses to determine the optimum routing of traffic through the San Francisco port system under different levels of national crises. Also, alternatives for improvement of navigation and land facilities to accommodate national defense requirements will be analyzed.

a. Initial Analyses. These analyses will consist of the development of basic data and the formulation of tentative port related defense concepts. These investigations will include:

(1) Comprehensive inventory of San Francisco Bay Region national defense facilities.

(2) Determination of critical national defense factors and the role of the San Francisco Bay port system in respect to those national defense considerations.

b. Subsequent analyses. These studies will be based upon inventory data and preliminary evaluation of the port system relative to national defense. Investigation subjects will include:

(1) Appraisal of present and future operational procedures and necessary capacities for port facilities in the San Francisco Bay port system in time of national crisis.

(2) Analyses of the effect of national defense maritime requirements on commercial navigation facilities.

(3) Analyses of the effect of closing one or more ports to determine the optimum routing of traffic under national crisis conditions through the San Francisco Bay port system.

(4) Analyses of anticipated problems dealing with handling and movement of hazardous cargoes (e.g., radioactive wastes, oil) within the San Francisco Bay system from the standpoint of both national defense and port safety considerations.

(5) Summation of future requirements as related to navigation facilities to meet national defense needs.

(6) Development of alternatives for improvements and modifications in navigation and related land facilities as determined by evaluation of future requirements for national defense and general navigation.

## RESULTS OF PUBLIC HEARINGS

In accordance with recommendations presented in the Preliminary Plan of Study, the initial phase of preparing the Detailed Plan of Study involved three public hearings which were held on 2, 5, and 11 June 1970 in Oakland, Martinez, and Sacramento, California, respectively. At those hearings, various governmental agencies, civic groups, and individuals expressed an overall support for the study. Excerpts of hearing statements are presented in Appendix B.

General areas of interest expressed at the hearings and later correspondence involved vessel trends, channel depths, time lag between studies and plan implementation, and environmental aspects such as pollution. Other biological and conservation interests were expressed regarding obliteration of benthic communities, turbidity from dredging, and disturbance of freshwater aquifers.

Statements presented by several State agencies, including the Water Resources Control Board, the Department of Navigation and Ocean Development, and Department of Commerce indicated direct support for the In-Depth Study and presented detailed items regarding the State's interest in environmental as well as economic factors relating to navigation development. Also, statements presented by regional agencies, notably the Association of Bay Area Governments and the Regional Transportation Planning Commission, expressed support for the study and presented recommendations for studies concerning such items as oil pollution, transportation systems, employment, commodity movement and others. Statements presented by industrial interests indicated strong support for the In-Depth Study and expressed the great need for research into such areas as current and future import and export commerce, transportation requirements, and other factors relating to regional as well as national economic growth and development.

Several agencies, particularly the Ports of Oakland, Sacramento and Stockton questioned the scope of the study and the propriety of the Federal Government going beyond historical navigation studies. They suggested that investigations be primarily geared toward future developments of super-ships and their relationship to oceanborne commerce. Other areas questioned by the ports concerned the Congressional Resolution objectives which appeared to them to point toward the Federal Government dictating to local interests in such matters that are, and have been, purely local areas of concern. It was stated that matters such as improvements in harbor and industrial operations, programming, solicitation, market research, public relations, advertising and long-term planning, concern port operations and should be a local rather than a Federal responsibility to plan and control.



## COORDINATION WITH FEDERAL, STATE, REGIONAL AND LOCAL INTERESTS

Subsequent to the June public hearings, continuing review and research of data concerning the activities related to navigation and waterborne commerce provided additional information upon which to further establish the structure of the Detailed Plan. Concurrent with those investigations, during the months of October, November and December meetings were held with Federal, State, regional and local agencies and representatives to review and discuss the progress and context of the Detailed Plan formulation.

On 5 October a meeting was held with all the available Federal agencies participating in the In-Depth Study (See Table 3). At this meeting the objectives, scope, working procedures, and study content were presented and discussed. In response to the information presented, the various Federal agencies were asked to submit comments concerning the following:

- a. Possible additional items of study or additional definitions of currently identified items.
- b. The area of participation by each agency in the total study matrix.
- c. Information on all existing and/or planned investigations that may relate to all or part of this investigation, including estimated time schedules and costs.
- d. Time and cost estimates related to conducting investigations considered pertinent to the In-Depth Study.

Additional meetings were held upon request with the individual Federal agencies in order to clarify individual participation.

On 19 October, 6 November and 16 December meetings were held with the Local Review and Advisory Group that was formed to provide assistance during the preparation of the Detailed Plan of Study. A progress report, including objectives, scope and basic content of the study, was presented to the group. Members of this group represent the Marine Affairs Conference, petroleum industry, general industry, rails and utilities, conservation groups, and port representatives. Comments concerning the progress and content of the In-Depth Study were requested from this group.

A meeting with representatives from the regional agencies of the San Francisco Bay Region was held in Sacramento on 17 November. The represented agencies were the Association of Bay Area Governments, the Sacramento Regional Area Planning Commission, the Sacramento County Planning Department, and the San Joaquin County Planning

Department. At this meeting the progress, scope, and basic content of the study was presented, and the agencies were requested to submit written comments concerning their views toward the In-Depth Study. Also, a listing and description of all existing or in progress regional investigations related to the In-Depth Study were requested.

Various agencies of the State of California were formally presented a progress review of the In-Depth Study in Sacramento on 24 November. Procedures for conducting the overall study as well as the basic content of the investigation were presented and discussed. Written statements and comments were requested from the State agencies on the In-Depth Study.

Comments from the Federal, State, regional and local agencies and groups are included in Appendix B as part of the Detailed Plan of Study.

#### TIME AND SEQUENCE SCHEDULE OF STUDY PROGRAM

The San Francisco Bay Area In-Depth Study is to be planned and scheduled by the use of Critical Path Network (CPN). The critical path represents the longest, in time, of all the numerous paths of activities to be covered in a particular program. The critical path for the development of the Detailed Plan of Study is shown of Exhibit 1. Starting with the completed Detailed Plan of Study, the critical path, as shown on Exhibit 2, covers the work activities of the Corps of Engineers and participating agencies in the overall study. Exhibit 2 also indicates the broad job or activity essential to the study from start to finish, including work required to properly delineate the select areas of study and the identification of activities essential in maintaining study progress on schedule.

The organized sequential development of the study areas and delineation of work schedules of study participants assures proper input time and portrays the points at which each activity must be completed before the next activity can begin. The procedure allows flexibility in scheduling work and provides for optimum utilization of available manpower and funds during the course of the overall study. It is estimated that five fiscal years will be required to complete the entire study after approval of the Detailed Plan of Study.

#### PARTICIPATING AGENCIES IN THE STUDY PROGRAM

Conduct of the study will require drawing on a vast array of highly specialized technical skills and knowledge. No one Federal agency has either the capability or expertise in all disciplines

to be covered in this study. Hence the study is conceived as a coordinated partnership among Federal agencies and non-Federal interests. Each agency would be expected to lead in those subjects and areas of the study in which it has a special competence. Coordination effort during the preparation of the Detailed Plan of Study has resulted in the composition of Federal study participants as shown on Table 3, Participation Matrix. Agency functions and agency abbreviations as shown on the participation matrix are explained in Appendix A of this report. Several Federal agencies have indicated that their participation in the study would be limited to supplying specific data upon request, and therefore, they have been omitted from the Participation Matrix. These agencies are: the Department of Health, Education and Welfare; Atomic Energy Commission; Federal Power Commission; Federal Maritime Commission; Interstate Commerce Commission; and, the Commodity Credit Corporation.

#### ESTIMATES OF STUDY COSTS

The cost estimates relating to the specific study elements associated with a Federal agency's area of competence and established responsibilities were derived through correspondence and subsequent discussions and meetings. Study cost estimates were based on study element outlines provided by the Corps of Engineers and the resultant cost estimates were reflective of available data from existing reports and on-going studies of both Federal and non-Federal efforts. It was necessary in some instances to make adjustments to study cost estimates submitted by others in order to eliminate duplication of efforts and to limit the scope of the study elements only to that necessary for accomplishing the study objective. Total study costs have been estimated to amount to \$4.5 million, spread over five fiscal years, FY 1972 through FY 1976. Not included in this total are the costs incurred to date by the Corps of Engineers toward the preparation of the Preliminary Plan of Study and the Detailed Plan of Study, \$140,000, nor the \$90,000 that have been authorized for initiation of the study in the latter part of Fiscal Year 1971, upon approval of the Detailed Plan of Study. Study cost estimates by agencies are shown on Table 1.

#### CONCLUSIONS

Studies, meetings and discussions completed to date relative to the San Francisco Bay Area In-Depth Study indicate that:

1. The report will provide guidelines for alternative regional navigation plans for future development of the Bay Region. The provision for reporting separately specific projects that may be required to meet current and near term development needs, if they meet certain tests, is considered appropriate.



2. There is a favorable and widespread interest in the study. In the views of local interests, findings of the study are expected to meet a critical regional planning need and would be beneficial to the region, State and the Nation.

3. The study will be a multiple agency and multiple governmental level effort and will reflect active participation by private groups and interests.

4. A significant non-Federal contribution toward investigation phases of the study can be expected from concurrent and specific local planning programs.

5. Federal agencies included in the Participation Matrix (Table 3) have indicated their willingness to participate and contribute to the study and it is considered their participation is appropriate to fulfill the objective and comprehensive scope of the study.

6. The complexity of the problems involved in the In-Depth Study requires that the study procedures delineated in the Detailed Plan of Study should remain flexible so as to allow change of direction, emphasis and timing of the study if unforeseen developments during the course of the study warrant such changes.

7. It is estimated that the funds required for the study amount to \$4.5 million, with the Corps of Engineers portion being \$2.05 million, and the portion for the other participating Federal agencies being \$2.45 million. The study would require five years to complete after approval of the Detailed Plan of Study. Major study effort will be conducted during the three-year period, FY 1973 through FY 1975.

8. The expected benefits to be derived from the study by both national and regional interests support the need for the continuation and completion of the study.

#### RECOMMENDATIONS

It is recommended that:

1. The Detailed Plan of Study presented herein be approved as a guide to the scheduled studies.

2. The previously authorized funds for FY 1971 in the amount of \$90,000 be released to initiate the scheduled studies.

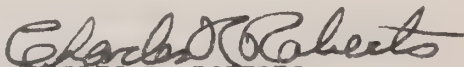
  
CHARLES R. ROBERTS  
Colonel, CE  
District Engineer

TABLE 1  
SAN FRANCISCO BAY AREA IN-DEPTH STUDY  
COORDINATED STUDY COST ESTIMATES  
(IN \$1,000)

STUDY ANALYSIS	DEFENSE							COMMERCE						TRANSPORTATION				EPA	INTERIOR						HUD	LABOR	AGRICULTURE		TOTAL
	CE <sup>1/</sup>	MTMTS	AMC	MSTS	NMC	NAVY	ARMY	MARAD	OFS <sup>3/</sup>	BOC	OBE	BDSA	BIC	CG	FHWA	FRA	FAA	FWQA	FWLS	USGS	BOM	BOR	NPS	ORA	BLS	ERS	SCS		
COMMODITY FLOW	290							30	40	→			→	10							25				60	30		485	
VESSELS AND PORT FACILITIES	740							100	15			→		20				30	30									935	
TRANSPORTATION SYSTEMS	50							40						120	230	140	100						40					720	
ENVIRONMENTAL	180													8				260	90	200	15	40	7	40			70	910	
SOCIAL WELL-BEING	250							10	45		→	→	→	12					20			50	13	100	130	60		690	
NATIONAL DEFENSE	50	15	6	6	6	6	6	5						8														108	
MAIN REPORT <sup>2/</sup>	490							40						12				30	20					30		30		652	
TOTAL	2050	15	6	6	6	6	6	225	100	→	→	→	→	190	230	140	100	320	160	200	40	90	20	210	190	120	70	4500	

NOTE:

- SEE APPENDIX A FOR DEFINITION OF AGENCY ABBREVIATION.
- MAIN REPORT COST INCLUDES THOSE FOR SELECTION AND EVALUATION OF ALTERNATIVE PORT SYSTEMS AND COORDINATION

- STUDY COST ESTIMATES SHOWN FOR OFFICE OF FIELD SERVICE (OFS) INCLUDE COST FOR COORDINATING INPUTS OF THE OTHER DEPARTMENT OF COMMERCE AGENCIES INDICATED BY ARROWS FOR THE APPROPRIATE ANALYSES.





TABLE 2

## SAN FRANCISCO BAY AREA IN-DEPTH STUDY

## ADVISORY COMMITTEE

FEDERAL AGENCIES	STATE AGENCIES	REGIONAL AGENCIES	LOCAL INTEREST
Corps of Engineers, Chrmn. Department of Defense	Department of Navigation and Ocean Development	Association of Bay Area Governments	Marine Affairs Conference
Maritime Administration Department of Commerce	Department of Fish and Game	Sacramento Regional Area Planning Commission	Petroleum Industry
Coast Guard Department of Transportation	Department of Public Works	Sacramento County Planning Commission	General Industry
Federal Water Quality Admin. Environmental Protection Agency	San Francisco Bay Area Conservation and Development Commission	San Joaquin County Planning Commission	Rail and Utility
Fish and Wildlife Service Department of the Interior	Metropolitan Transportation Commission		Conservation
Department of Housing and Urban Development			Port Representatives
Economic Research Service Department of Agriculture			San Francisco Redwood City Oakland Richmond Benicia Stockton Sacramento



**TABLE 3**  
**SAN FRANCISCO BAY AREA IN-DEPTH STUDY**  
**FEDERAL AGENCY PARTICIPATION MATRIX**

ANALYSES	DEFENSE							COMMERCE						TRANSPORTATION				EPA	INTERIOR						HUD	LABOR	AGRICULTURE	
	CE	MTMTS	AMC	MSTS	NMC	NAVY	ARMY	MARAD	OFS	BOC	OBE	BDSA	BIC	CG	FHWA	FRA	FAA	FWQA	FWLS	USGS	BOM	BOR	NPS	ORA	BLS	ERS	SCS	
1. COMMODITY FLOW	*							✓	✓	✓			✓	✓							✓				✓	✓		
2. VESSELS AND PORT FACILITIES	*							✓				✓		✓				✓	✓									
3. TRANSPORTATION SYSTEMS	✓							✓						*	✓	✓	✓							✓				
4. ENVIRONMENTAL	✓													✓				*	✓	✓	✓	✓	✓	✓			✓	
5. SOCIAL WELL-BEING	*							✓			✓	✓	✓	✓					✓			✓	✓	✓	✓	✓		
6. NATIONAL DEFENSE	*	✓	✓	✓	✓	✓	✓	✓						✓														

LEGEND  
 \* STUDY COORDINATOR  
 ✓ STUDY PARTICIPANT





TABLE 4

EXISTING NAVIGATION DEVELOPMENT SAN FRANCISCO BAY AND DELTA AREA

PROJECT	AUTHORITY	NAVIGATION FEATURES	CUMULATIVE FEDERAL COSTS TO 1968 (DOLLARS)		1968 WATBORNE COMMERCE (TONS)
			MAINT.	CONST.	
DEEP DRAFT:					
SAN FRANCISCO HARBOR	RIVER & HARBOR ACTS 1927 TO 1937	CHANNEL 50 FEET DEEP AND 2000 FEET WIDE THROUGH THE SAN FRANCISCO BAR; APPROACH CHANNEL ISLAIS CREEK, 35 FEET DEEP; AND, A CHANNEL 750 FEET WIDE AND 10 FEET DEEP TO SAN FRANCISCO AIRPORT ENDING IN A BASIN ABOUT 2000 FEET AND 10 FEET DEEP. ALL PROJECTS COMPLETED.	5,100,000	2,700,000	4,400,000
REDWOOD CITY HARBOR	RIVER & HARBOR ACTS 1910 TO 1950	CHANNEL 500 FEET WIDE AND 30 FEET DEEP ACROSS SAN BRUNO SHOAL; CHANNEL 300 FEET WIDE AND 30 FEET DEEP TO THE APPROXIMATE VICINITY OF THE CONFLUENCE OF WESTPOINT SLOUGH AND REDWOOD CREEK; TURNING BASIN AT THAT LOCATION 2,300 FEET LONG AND FROM 400 TO 900 FEET WIDE; CHANNEL 400 FEET WIDE, 30 FEET DEEP AND 1300 FEET LONG, WIDENING INTO A SECOND TURNING BASIN 900 FEET WIDE, 1,700 FEET LONG AND 30 FEET DEEP; AND A SHALLOW CHANNEL 150 FEET WIDE AND 5 FEET DEEP EXTENDING TO STEINBERGER SLOUGH. ALL PROJECTS COMPLETED.	1,900,000	1,700,000	3,000,000
OAKLAND HARBOR	RIVER & HARBOR ACTS 1922 TO 1945	CHANNEL IN THE OUTER HARBOR 35 FEET DEEP AND 600 TO 950 FEET WIDE, INCLUDING A TURNING BASIN 35 FEET DEEP AND 950 FEET WIDE; CHANNEL IN THE INNER HARBOR 30 FEET DEEP VARYING FROM 275 TO 800 FEET IN WIDTH TO THE PARK STREET BRIDGE AND CONTINUING AT A DEPTH OF 18 FEET AND A WIDTH OF 275 FEET THROUGH THE TIDAL CANAL TO SAN LEANDRO BAY; CHANNEL 25 FEET DEEP AND 300 FEET WIDE AT THE NORTH END OF BROOKLYN BASIN; A NORTH JETTY AND A SOUTH JETTY AT THE ENTRANCE OF THE INNER HARBOR, 9,500 FEET AND 12,000 FEET RESPECTIVELY; AND, FOUR BRIDGES ACROSS THE TIDAL CANAL, TWO OF WHICH HAVE BEEN REPLACED BY LOCAL INTERESTS TO MEET TRAFFIC NEEDS FOR ENLARGED HIGHWAY CROSSINGS. ALL PROJECTS COMPLETED EXCEPT DEEPENING OF THE TIDAL CANAL.	9,600,000	5,700,000	4,600,000
RICHMOND HARBOR	RIVER & HARBOR ACTS 1917 TO 1954	CHANNEL 35 FEET DEEP AND 600 FEET WIDE THROUGH SOUTHAMPTON SHOAL TO THE OUTER HARBOR; ENTRANCE CHANNEL TO THE INNER HARBOR 35 FEET DEEP AND 600 FEET WIDE TO A TURNING BASIN AT POINT RICHMOND, THENCE CONTINUING AT THE 35 FOOT DEPTH WITH A WIDTH OF FROM 500 TO 600 FEET TO POINT PORTRERO; AN INNER HARBOR CHANNEL 35 FEET DEEP AND 850 FEET WIDE TO THE ENTRANCE OF THE SANTA FE CHANNEL AND CONTINJING AT A DEPTH OF 30 FEET THROUGH THE SANTA FE CHANNEL AND THE TURNING BASIN; A RUBBLE MOUND TRAINING WALL 10,000 FEET LONG (PARALLEL TO THE CHANNEL BETWEEN POINT RICHMOND AND POINT PORTRERO) EXTENDING WESTERLY FROM BROOKS ISLAND; AN APPROACH AREA 32 FEET DEEP IN THE OUTER HARBORS AT POINT ORIENT AND POINT SAN PABLO; A CHANNEL 20 FEET DEEP, 150 FEET WIDE AND ABOUT 2,000 FEET LONG ALONG THE NORTH SIDE OF POINT SAN PABLO; AND A MANEUVERING AREA AT THE RICHMOND LONG WHARF 35 FEET DEEP. ALL PROJECTS COMPLETED.	3,700,000	2,900,000	16,200,000
SAN PABLO BAY AND MARE ISLAND STRAIT.	RIVER & HARBOR ACTS 1902 TO 1945	CHANNEL 35 FEET DEEP, 600 FEET WIDE AND ABOUT EIGHT MILES LONG IN SAN PABLO BAY ACROSS THE PINOLE SHOAL; A CHANNEL 30 FEET AND 700 FEET WIDE THROUGH MARE ISLAND STRAIT TO A TURNING BASIN ABOUT 1,000 FEET WIDE BETWEEN VALLEJO AND MARE ISLAND, AND TWO APPROACH AREAS 20 FEET DEEP TO THE WATERFRONTS AT VALLEJO; AND FOR MAINTENANCE BY THE CORPS OF ENGINEERS OF TWO APPROACH AREAS TO THE NAVY YARD PIERS AT THE SOUTHERN END OF MARE ISLAND.	10,400,000	1,400,000	5,600,000
CARQUINEZ STRAIT AND SUISUN BAY	RIVER & HARBOR ACTS 1927 TO 1960	NAVIGATION CHANNEL THROUGH THE UPPER REACHES OF CARQUINEZ STRAIT AND THE LOWER SUISUN BAY 30 FEET DEEP AN 200 FEET WIDE TO CHIPPS ISLAND. ALL PROJECTS COMPLETED.	2,300,000	200,000	11,800,000
SAN JOAQUIN RIVER AND PORT OF STOCKTON	RIVER & HARBOR ACTS 1927 TO 1960	30 FOOT CHANNEL, 400 FEET WIDE, FROM SUISUN BAY AT PITTSBURG TO VENICE ISLAND AND 225 FEET WIDE FROM VENICE ISLAND TO STOCKTON; CHANNEL IMPROVEMENTS AT STOCKTON AND OTHER RELATED DEVELOPMENTS. ALL PROJECTS COMPLETED.	5,700,000	5,800,000	3,800,000
SACRAMENTO DEEP WATER SHIP CHANNEL AND PORT OF SACRAMENTO	RIVER & HARBOR ACT 1946	CHANNEL 30 FEET DEEP, 43 MILES LONG FROM DEEP WATER IN SUISUN BAY TO SACRAMENTO; AND A TRIANGULAR HARBOR AND TURNING BASIN 2000 FEET BY 4,000 FEET AND 30 FEET DEEP AT LAKE WASHINGTON. THE SHIP CHANNEL FOLLOWS WIDENED AND DEEPENED EXISTING CHANNELS IN THE LOWER SACRAMENTO RIVER AND CACHE SLOUGH AND AN EXCAVATED CHANNEL WITH A DEPTH OF 30 FEET AND A BOTTOM WIDTH OF 200 TO 300 FEET, NORTH TO THE PORT. ALL PROJECTS COMPLETED.	2,600,000	39,300,000	1,800,000
SHALLOW DRAFT:					
SAN RAFAEL CREEK PETALUMA RIVER NAPA RIVER	RIVER & HARBOR ACTS 1902 TO 1945	CHANNEL 6 FEET DEEP AND 100 FEET WIDE DREDGED IN SAN RAFAEL CREEK; CHANNEL 8 FEET DEEP AND 100 FEET WIDE IN THE PETALUMA RIVER; CHANNEL IN THE NAPA RIVER VARYING FROM A DEPTH OF 15 FEET AND A WIDTH OF 100 FEET IN THE LOWER REACHES TO A DEPTH OF 10 FEET AND A WIDTH OF 75 FEET IN THE UPPER REACHES. ALL PROJECTS COMPLETED.	2,300,000	1,100,000	500,000
SUISUN CHANNEL	RIVER & HARBOR ACTS 1910 & 1937	CHANNEL 8 FEET DEEP, 200 FEET WIDE AT ENTRANCE, 100-125 FEET WIDE REMAINING PART OF CHANNEL TO SUISUN CITY, 13 MILES NORTH OF MOUTH; AND A TURNING BASIN 275 FEET WIDE AND 600 FEET LONG. ALL PROJECTS COMPLETED.	500,000	200,000	50,000
SACRAMENTO RIVER	RIVER & HARBOR ACTS 1875 TO 1935	CHANNEL 10 FEET DEEP, 150-200 FEET BOTTOM WIDTH, FROM SUISUN BAY TO SACRAMENTO; CHANNEL 6 FEET DEEP BETWEEN SACRAMENTO AND COLUSA; CHANNEL 5 FEET DEEP BETWEEN COLUSA AND CHICO LANDING; AND A BARGE CANAL WITH NAVIGATION LOCKS, WITH MINIMUM DEPTH OF 13 FEET CONNECTING THE DEEP WATER SHIP CHANNEL TO THE SACRAMENTO RIVER. ALL PROJECTS COMPLETED.	10,500,000	600,000	100,000
MIDDLE RIVER	RIVER & HARBOR ACTS 1930 & 1935	CHANNELS 9 FEET DEEP AND 100 FEET WIDE IN MIDDLE RIVER BELOW BORDEN HIGHWAY BRIDGE; IN LATHAM SLOUGH BETWEEN MIDDLE RIVER AND EMPIRE CUT; AND IN EMPIRE CUT, WISKEY SLOUGH AND TURNER CUT BETWEEN MIDDLE RIVER AND SAN JOAQUIN RIVER.	50,000	NEG.	NEG.
MOKELUMNE RIVER	RIVER & HARBOR ACT 1884	CLEARING AND REMOVAL OF SNAGS AND OBSTRUCTIONS AND OCCASIONAL DREDGING OF SHOALS FROM MOUTH OF RIVER TO GALT-NEW HOPE BRIDGE, A DISTANCE OF 35 MILES, INCLUDING BOTH FORKS.	150,000	NEG.	50,000
OLD RIVER	RIVER & HARBOR ACT 1937	CHANNELS RANGING FROM 5 TO 10 FEET DEEP EXTENDED ALONG OLD RIVER FROM ITS MOUTH NEAR VENICE ISLAND TO ITS SOURCE IN THE SAN JOAQUIN RIVER NEAR MOSSDALE.	500,000	NEG.	100,000
TOTAL			55,300,000	61,600,000	52,000,000

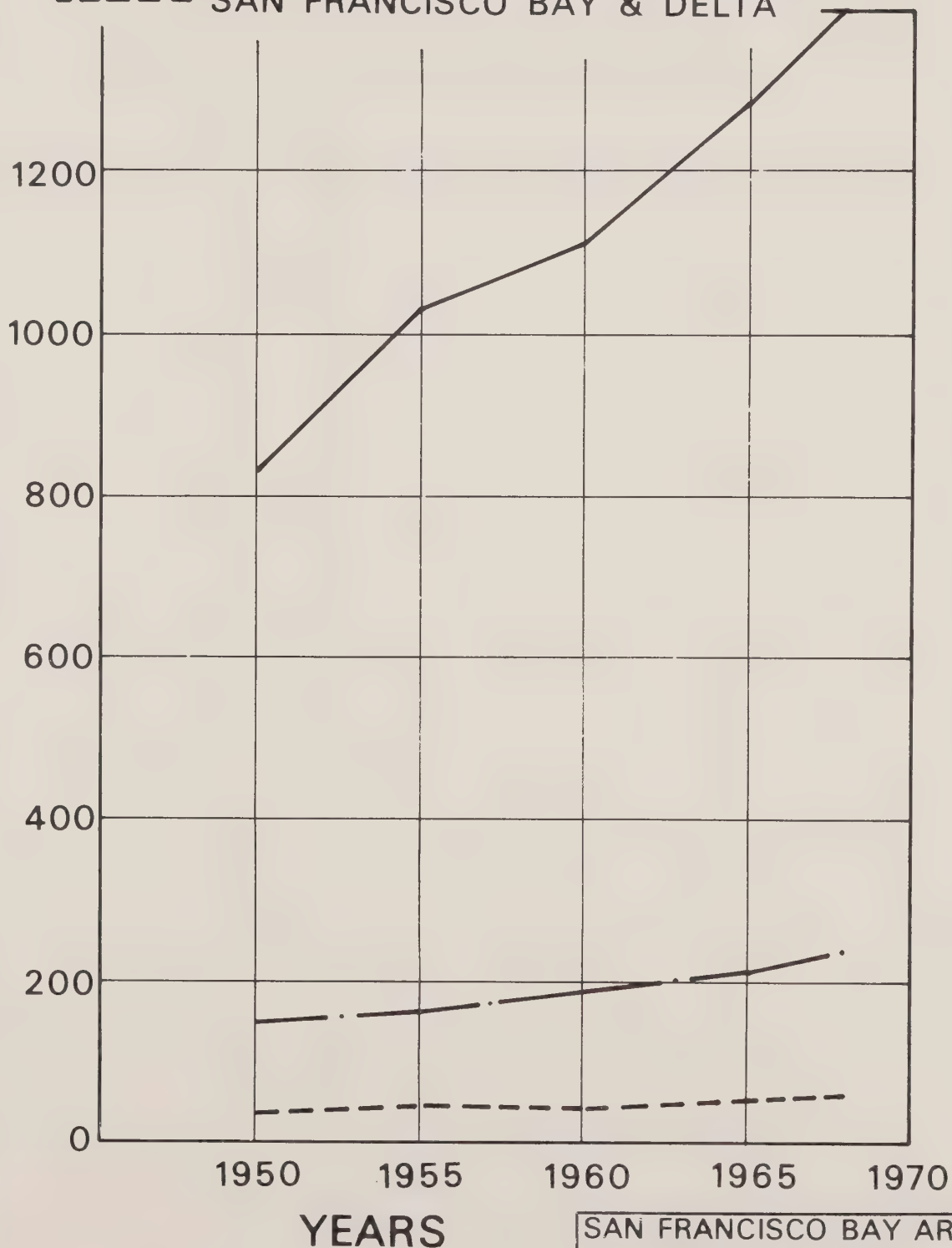




**LEGEND:**

- UNITED STATES
- · — WEST COAST ( INCLUDES HAWAII & ALASKA )
- SAN FRANCISCO BAY & DELTA

TOTAL WATERBORNE COMMERCE IN MILLION TONS



SAN FRANCISCO BAY AREA  
IN-DEPTH STUDY

**WATERBORNE  
COMMERCE**

IN 4 SHEETS

SHEET NO. 1

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C. OF E.

DRAWN: FILE NO.

TRACED: TO ACCOMPANY REPORT

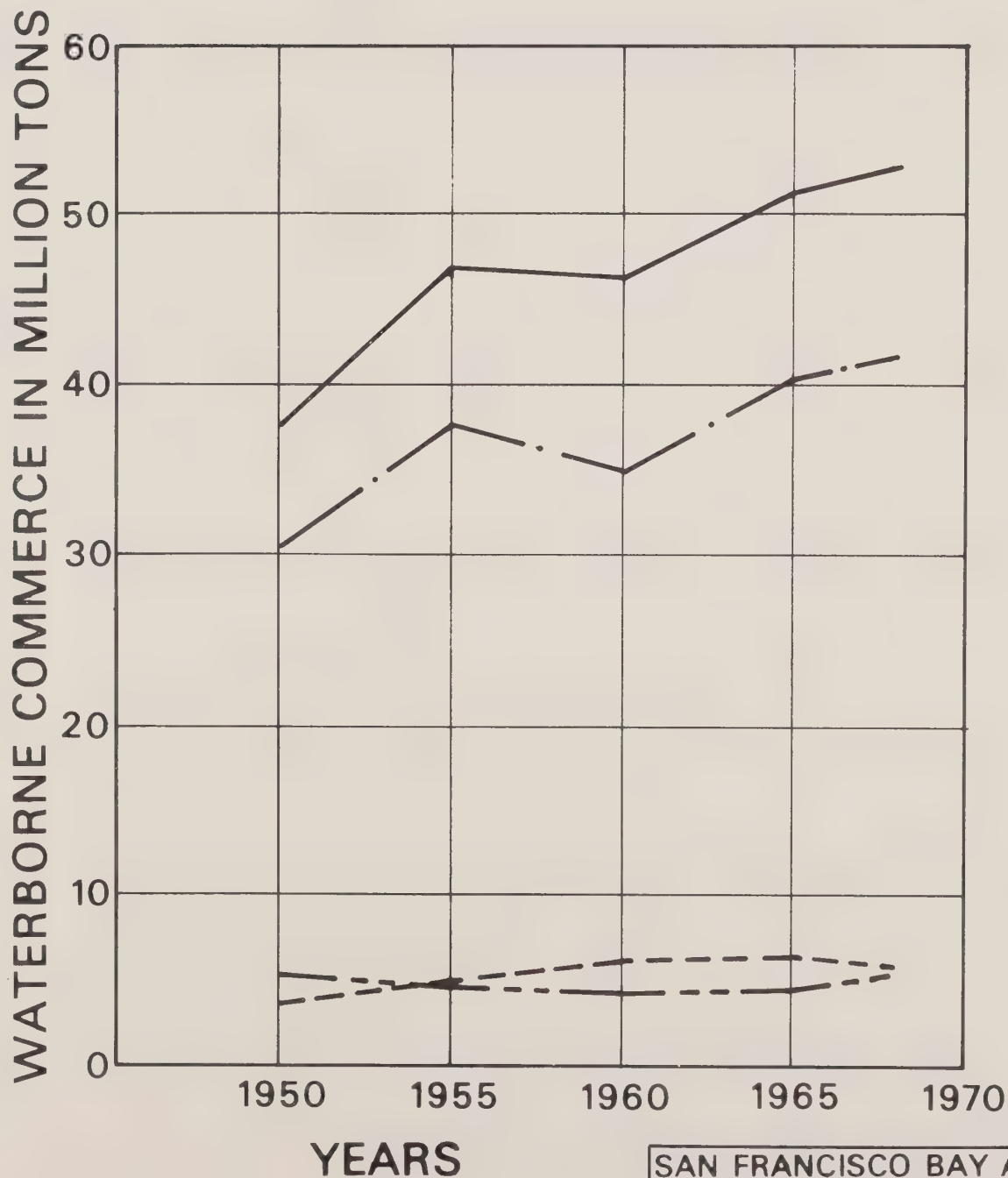
CHECKED: DATED: MARCH 1971 1-1-167

**FIGURE 1**



## LEGEND:

- TOTAL COMMERCE
- · — PETROLEUM AND LIQUID BULK
- - - - DRY BULK CARGOES
- · - - GENERAL CARGOES



SAN FRANCISCO BAY AREA  
IN-DEPTH STUDY  
WATERBORNE COMMERCE  
**SAN FRANCISCO BAY &  
DELTA PORTS**

IN 4 SHEETS

SHEET NO. 2

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C. OF E.

DRAWN: FILE NO.

TRACED: TO ACCOMPANY REPORT

CHECKED: DATED: MARCH 1971 1-1-167

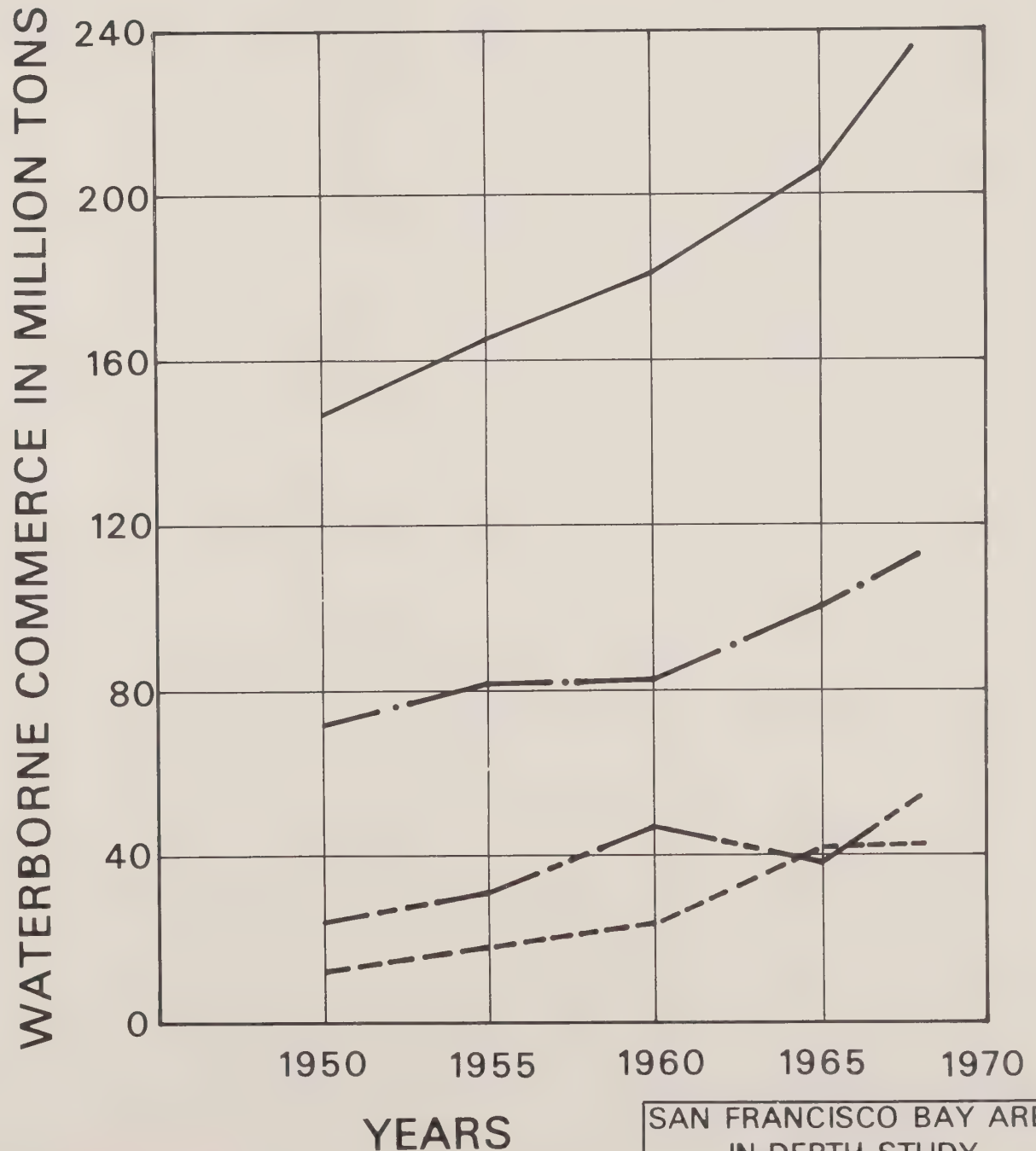
FIGURE 2





## LEGEND :

- TOTAL COMMERCE
- · - PETROLEUM & LIQUID BULK
- DRY BULK CARGOES
- GENERAL CARGOES



SAN FRANCISCO BAY AREA  
IN-DEPTH STUDY  
WATERBORNE COMMERCE  
**WEST COAST**  
( INCLUDES HAWAII & ALASKA )

IN 4 SHEETS

SHEET NO. 3

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C. OF E.

DRAWN:

FILE NO.

TRACED:

TO ACCOMPANY REPORT 1-1-167

CHECKED:

DATED: MARCH 1971

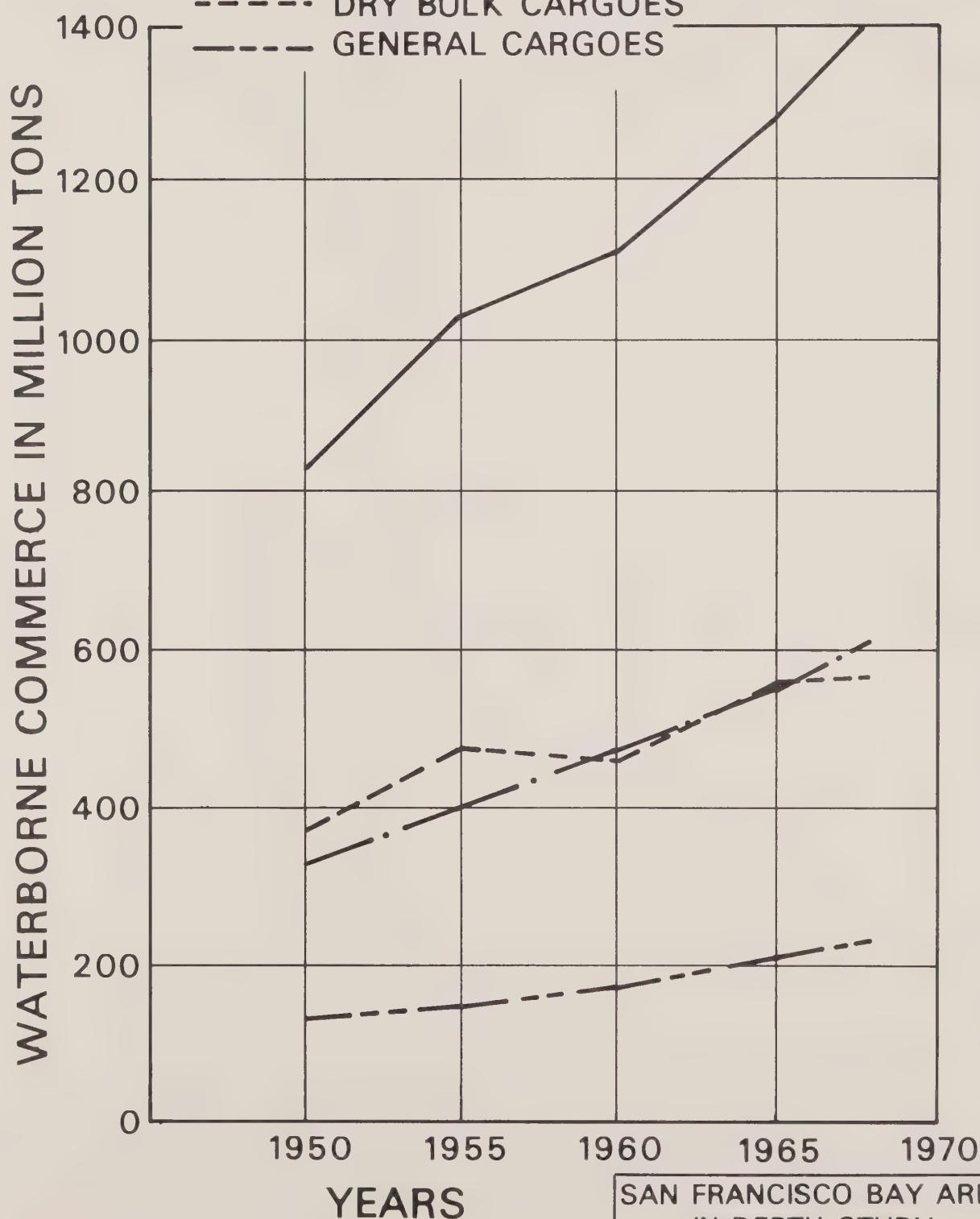
**FIGURE 3**





# LEGEND:

- TOTAL COMMERCE
- . — PETROLEUM AND LIQUID BULK
- - - - DRY BULK CARGOES
- - - - GENERAL CARGOES



SAN FRANCISCO BAY AREA  
IN-DEPTH STUDY

WATERBORNE COMMERCE

UNITED STATES

IN 4 SHEETS

SHEET NO. 4

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C. OF E.

DRAWN: FILE NO.

TRACED: TO ACCOMPANY REPORT

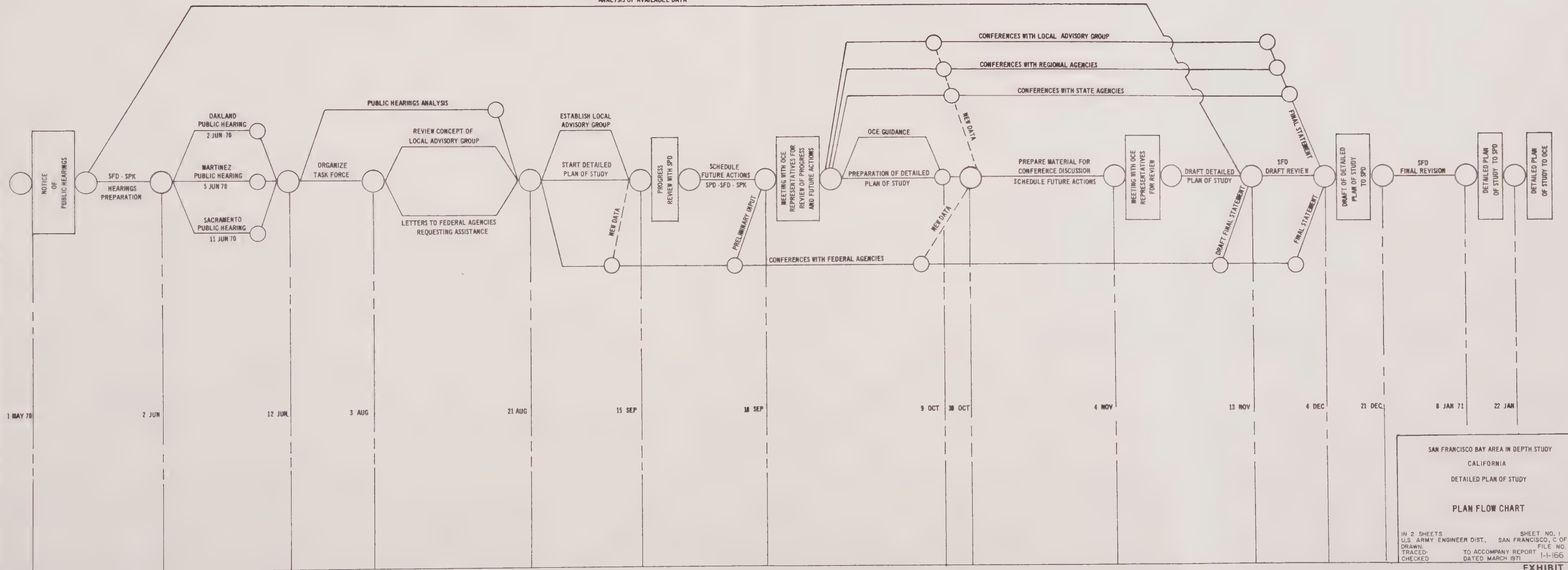
CHECKED: DATED: MARCH 1971 1-1-167

FIGURE 4



# SAN FRANCISCO BAY AREA IN-DEPTH STUDY FLOW CHART FOR DETAILED PLAN OF STUDY

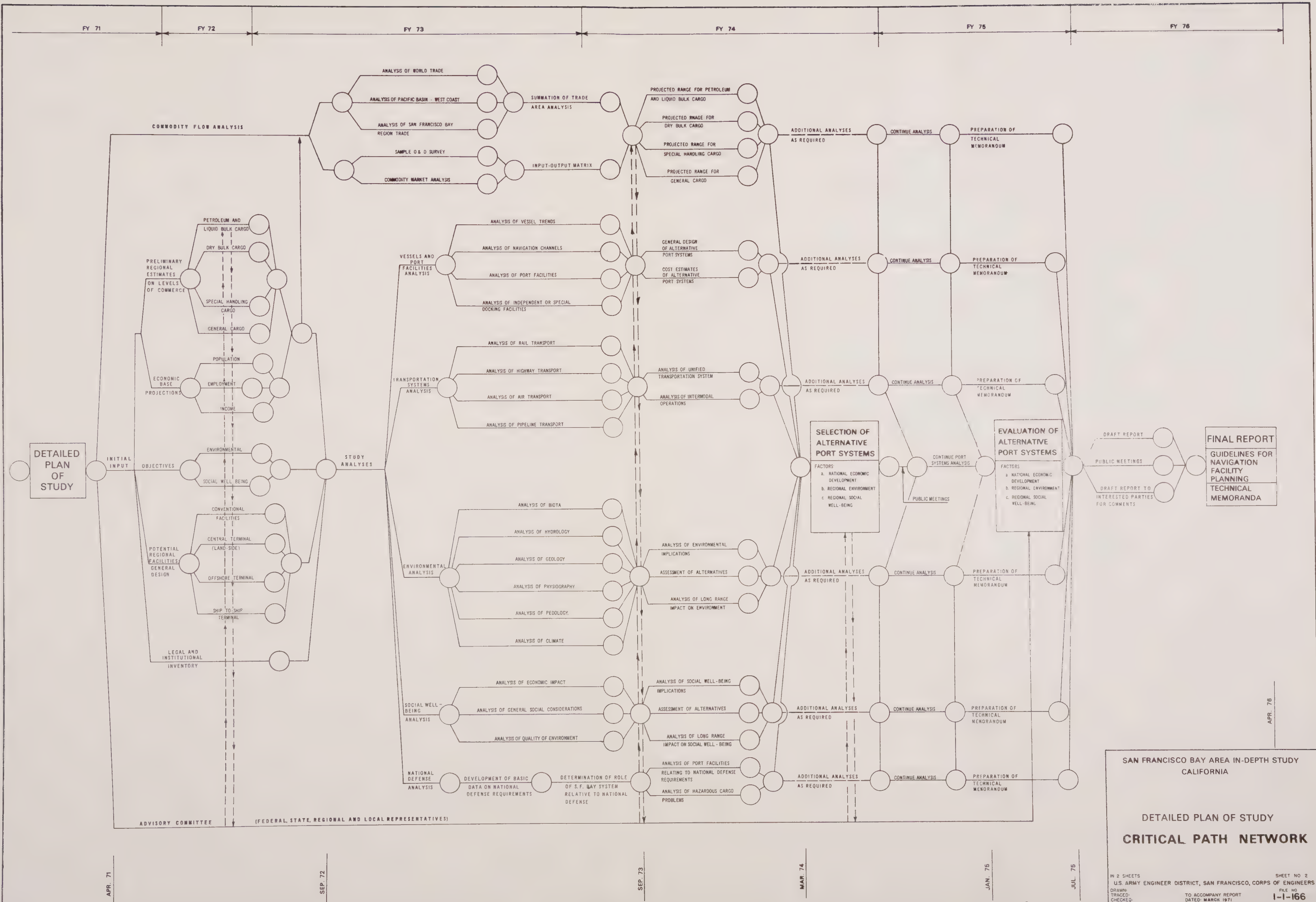
ANALYSIS OF AVAILABLE DATA



SAN FRANCISCO BAY AREA IN DEPTH STUDY  
CALIFORNIA  
DETAILED PLAN OF STUDY  
PLAN FLOW CHART  
IN 2 SHEETS  
U.S. ARMY ENGINEER DIST. SAN FRANCISCO, C OF E  
DRAWN: FILE NO.  
TRACED: TO ACCOMPANY REPORT 1-1-166  
CHECKED: DATED MARCH 1971

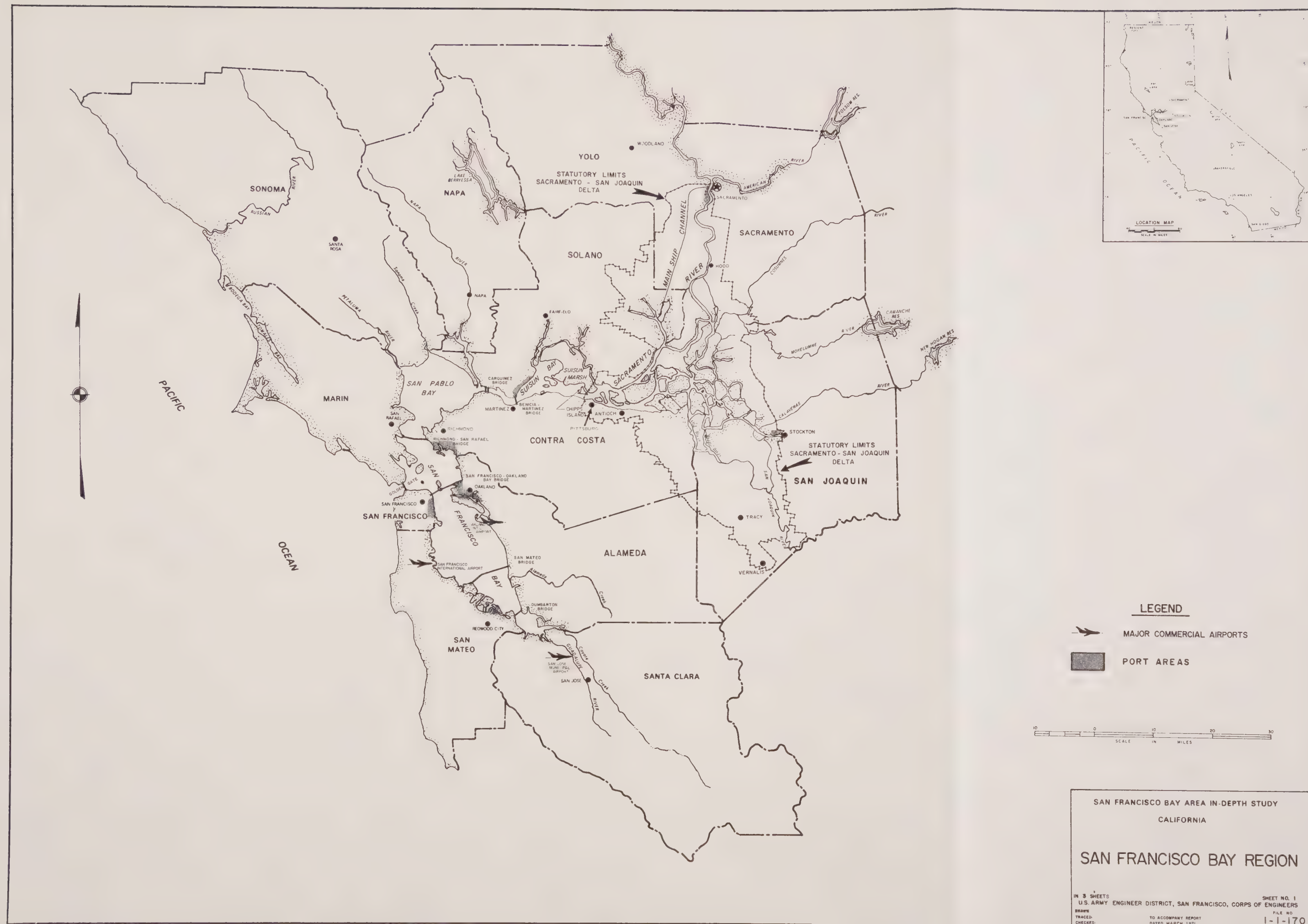
















# LEGEND

TRANSPORTATION SYSTEMS REGION

SAN FRANCISCO BAY AREA IN-DEPTH STUDY  
CALIFORNIA

TRANSPORTATION SYSTEMS  
REGION

IN 3 SHEETS  
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E  
DRAWN:  
TRACED:  
CHECKED:

SHEET NO. 2

FILE NO.

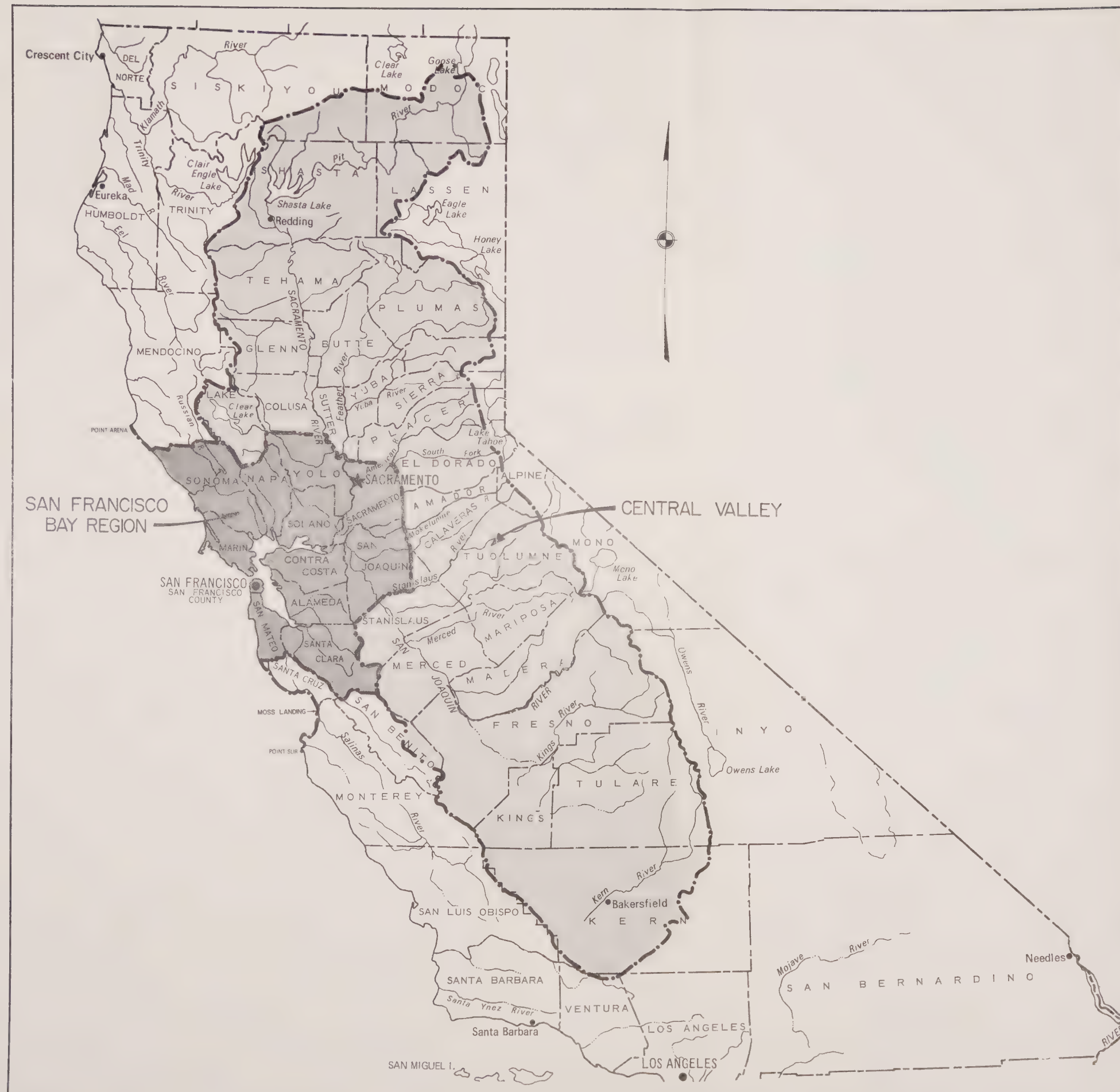
TO ACCOMPANY REPORT

DATED MAR 1971

1-1-170







SAN FRANCISCO BAY AREA IN-DEPTH STUDY:  
CALIFORNIA:  
SAN FRANCISCO BAY REGION  
AND  
CENTRAL VALLEY

IN 3 SHEETS SHEET NO. 3  
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO, CORPS OF ENGINEERS  
DRAWN: FILE NO.  
TRACED: 1-1-170  
CHECKED: TO ACCOMPANY REPORT DATED MARCH 1971





DETAILED PLAN OF STUDY  
SAN FRANCISCO BAY AREA IN-DEPTH STUDY

JANUARY 1971

APPENDIX A

FEDERAL DEPARTMENTS AND AGENCY FUNCTIONS



DETAILED PLAN OF STUDY  
SAN FRANCISCO BAY AREA IN-DEPTH STUDY

APPENDIX A

FEDERAL DEPARTMENTS AND AGENCY FUNCTIONS

DEPARTMENT OF DEFENSE

CE - Army Corps of Engineers - Under Civil Works program is authorized to investigate, plan and provide water and related land resources developments and has primary Federal responsibility for planning, construction, operation and maintenance of harbors and channels in the interest of navigation.

MTMTS - Military Traffic Management and Terminal Service - Responsible for military traffic management, land transportation and common-user ocean terminal service in the Department of Defense.

AMC - Army Material Command - Provides Army material, its distribution and transportation.

MSTS - Military Sea Transportation Service - Provides ocean transportation for personnel and cargo of the Department of Defense.

NMC - Navy Materiel Command - Provides materiel support for the Navy and Marine Corps.

DEPARTMENT OF COMMERCE

MARAD - Maritime Administration - Administers program for development, promotion and operation of the U.S. merchant marine. Has responsibility for promotion and development of ports and related transportation facilities including the investigation of territorial region and zones tributary to ports taking into consideration the economies of transportation by rail, water, highway, and pipeline, advising communities regarding type and appropriate location and advantages of port improvements for the most economic transfer of cargo between carriers, all in connection with the land and water flow of inland and ocean commerce.

OFS - Office of Field Service - To assist business firms to improve and expand their domestic and foreign operations. To serve as representative in region for departmental agencies which do not have regional offices.



BOC - Bureau of the Census - Collects, processes, and provides basic statistical data pertaining to population, agriculture, manufactures, mineral industries, business transportation, and U.S. foreign trade. Conducts surveys and provides data processing and advisory services to others.

OBE - Office of Business Economics - Prepares current and historical data and provides economic measures of the national economy, present and future. Conducts analyses of United States balance of international payments, and of factors affecting regional economic development, and performs economic research.

BDSA - Bureau of Defense Services Administration - Provides active assistance to business and industry in areas involving the industry and commerce of the United States. Collects, analyzes, and disseminates data on industrial requirements, technological developments, economic trends, and potential impact on business and economy of contemplated or effected Government actions.

BIC - Bureau of International Commerce - Promotes the foreign trade of the United States for the primary purpose of increasing U.S. exports. Provides information on marketing, investment, and economic conditions in foreign countries to determine export potentials and is the primary source of analyses of trade statistics of other nations.

#### DEPARTMENT OF TRANSPORTATION

CG - United States Coast Guard - Provides search and rescue services, develops and administers a merchant marine safety program to maintain a state of readiness for military operations in time of war or national emergency, provides a comprehensive system of aids to navigation for the Armed Forces and marine commerce, carries out an effective port security program and enforces or assists in the enforcement of Federal laws on the high seas or waters subject to the jurisdiction of the United States.

FHWA - Federal Highway Administration - Responsible for matters relating to the highway mode of transportation and coordination of highway transportation with other modes. Investigates programs which affect highways and road facilities and insures adequate replacement for highway transportation facilities rendered inadequate by relocations or construction of water resources projects, waterfront renewal, and port terminal relocation. Evaluates economic cost for highway adjustments caused by waterfront renewal programs.

FRA - Federal Railroad Administration - Provides unified national policy for rail transportation to fulfill present and future requirements.

FAA - Federal Aviation Administration - Regulates, promotes and controls the operation, development and use of aircraft in the interest of safety and efficiency.

#### ENVIRONMENTAL PROTECTION AGENCY

FWQA - Federal Water Quality Administration - Administers national program to enhance the quality and value of the Nation's water resources and assures the fulfillment of a national policy for prevention, control and abatement of water pollution. Concerned with propagation of fish and aquatic life and wildlife, recreation, agriculture, industry, and other uses.

#### DEPARTMENT OF THE INTERIOR

FWLS - Fish and Wildlife Service - Maintains the fishery and wildlife resources, commercial and sport, of the United States and determines probable effects of water resource projects on fish and wildlife. Recommends measures for preventing or reducing damages to these resources. Investigates effects of pollution on fish and wildlife.

USGS - United States Geological Survey - Collects, interprets, and disseminates data on mineral and water resources and the physical features of the country. Responsible for furnishing physical data needed for planning, design and operation of water resources development projects.

BOM - Bureau of Mines - Projects anticipated requirements of energy and mineral resources for national economic growth and development, including economic and statistical studies of domestic and foreign production, distribution and consumption.

BOR - Bureau of Outdoor Recreation - Coordinates Federal planning and activities relating to outdoor recreation resources, cooperating with states, political subdivisions and private interests.

NPS - National Park Service - Responsible for the conservation of the scenery, the natural and historical objects and areas, the wildlife, and for providing for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the employment of future generations.

## DEPARTMENT OF AGRICULTURE

ERS - Economic Research Service - Responsible for research and statistical analysis in field of agricultural economics and marketing, both foreign and domestic.

SCS - Soil Conservation Service - Develops and carries out a national program of soil and water conservation assistance to landowners and operators through their local soil and water conservation districts.

CCC - Commodity Credit Corporation - Procurement and exportation of agricultural commodities.

## DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

ORA - Office of the Regional Administrator - Responsible for regional coordination and administration of programs concerning research in the medical and related sciences such as health services and dissemination of medical knowledge, prevention of the introduction of communicable diseases into the United States, and promotion of the application of new knowledge for the prevention and control of disease.

## DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

ORA - Office of the Regional Administrator - Responsible to the Secretary and Under Secretary for the execution of the Department's programs assigned to the region in accordance with policies, standards, procedures, and delegations of authority with respect to Federal programs and activities relating to housing, urban development, and overall policies for fostering the orderly growth and development of the Nation's urban areas.

## DEPARTMENT OF LABOR

BLS - Bureau of Labor Statistics - Responsible for fact-finding in the field of labor economics and manpower, costs and standards of living.

## OTHER AGENCIES (FEDERAL)

AEC - Atomic Energy Commission - Provides national policy for development, use and control of atomic energy. Administers programs and encourages private participation in such programs. Responsible for directing or participating in programs related to vessel propulsion, port safety as well as legal and institutional constraints.

FPC - Federal Power Commission - Administers study plans for dams to be constructed and makes recommendations concerning facilities for hydroelectric power development. Assists in coordinating the development and utilization of water and related land resources. Makes studies on the potentials for power development, the market for potential power and the value of power.

ICC - Interstate Commerce Commission - Regulates commercial carriers, including railroads, trucking companies, buslines, freight forwarders, water carriers, oil pipelines, transportation brokers, and express agencies, which are engaged in transportation, in interstate commerce, and in foreign commerce to the extent it takes place within the United States.





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